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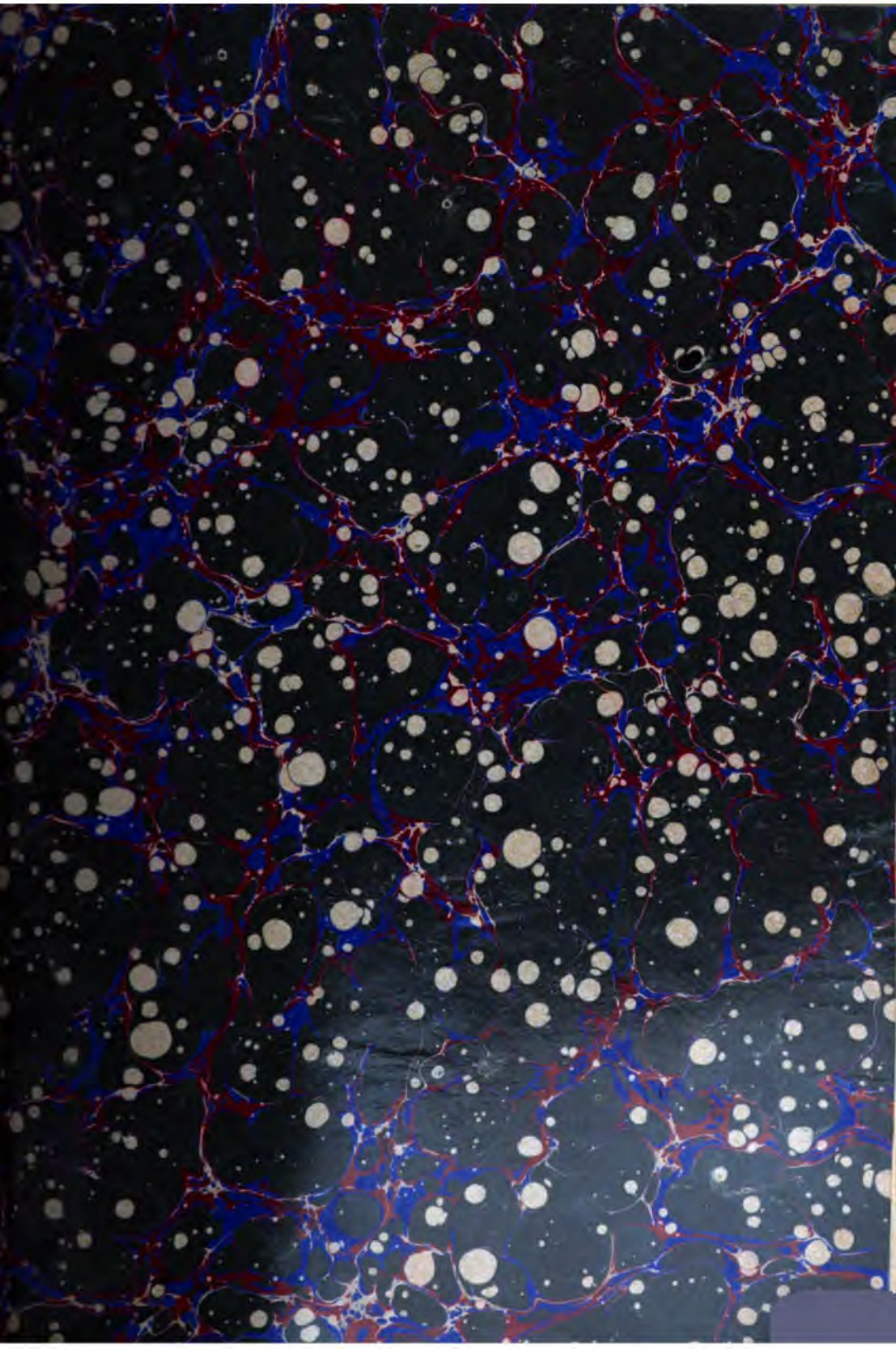

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PROCEEDINGS

OF THE

GENERAL MEETINGS FOR SCIENTIFIC BUSINESS

OF THE

ZOOLOGICAL SOCIETY

OF LONDON.

1904, vol. I.

PART I.

CONTAINING PAPERS READ IN

JANUARY AND FEBRUARY.

JUNE 1904.

PRINTED FOR THE SOCIETY,
SOLD AT THEIR HOUSE IN HANOVER SQUARE.
LONDON:
MESSRS. LONGMANS, GREEN, AND CO.,
PATERNOSTER-ROW.

[*Price Twelve Shillings.*]

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(JANUARY—APRIL.)

PRINTED FOR THE SOCIETY,
AND SOLD AT THEIR HOUSE IN HANOVER-SQUARE.

LONDON:
MESSRS. LONGMANS, GREEN, AND CO.,
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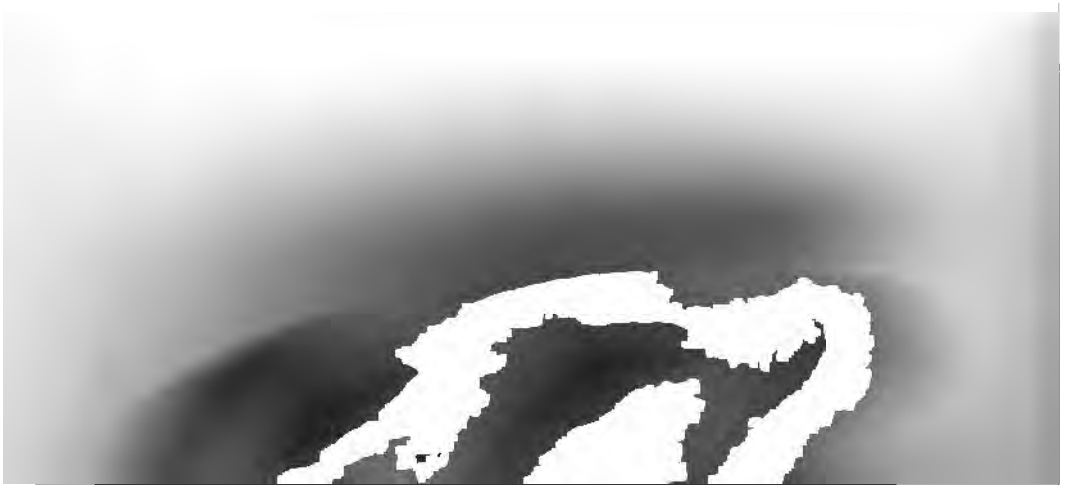

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P. CHALMERS MITCHELL, M.A., D.Sc.,
Secretary.

3 Hanover Square, London, W.,
June, 1904.

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OF THE

ZOOLOGICAL SOCIETY OF LONDON

FOR

SCIENTIFIC BUSINESS.

(AT 3 HANOVER SQUARE, W.)

Session 1903–1904.

1903.

TUESDAY, NOVEMBER 3 and 17 | TUESDAY, DECEMBER 1

1904.

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P. CHALMERS MITCHELL, M.A., D.Sc.,
Secretary.

June, 1904.

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PROCEEDINGS

OF THE

GENERAL MEETINGS FOR SCIENTIFIC BUSINESS

OF THE

ZOOLOGICAL SOCIETY OF LONDON.

1904, Vol. I. (January to April).

January 19, 1904.

G. A. Boulenger, Esq., F.R.S., Vice-President, in the Chair.

The Secretary read the following report on the additions made to the Society's Menagerie in November 1903:—

The registered additions to the Society's Menagerie during the month of November were 40 in number. Of these 9 were acquired by presentation, 2 by purchase, and 29 were received on deposit. The total number of departures during the same period, by death and removals, was 130.

Amongst the additions special attention may be directed to a fine young male Orang-Utan, obtained by purchase on Nov. 27. The animal is probably about six years old, and had been tamed by sailors. It is very active and lively, much more so than Orangs usually are in captivity, when they are very liable to mope and refuse food. This Orang had been placed in a compartment of the Ape House along with the Gibbon. It was chained at first and kept under observation. The Gibbon and the Orang, however, soon made friends, and although the latter is still, as a precaution, chained at night, the experiment seems to be a success and the two apes are much more lively and in better condition because of their association.

The Secretary read the following report on the additions to the Society's Menagerie during the month of December 1903:—

The registered additions to the Society's Menagerie during the

month of December 1903 were 54 in number. Of these 19 were acquired by presentation and 35 were received on deposit. The total number of deaths during the same period was 130.

The Secretary exhibited two skins of adult male specimens of *Trachelotis barrovii*, the common cinnamon-coloured Bustard of the Transvaal, and made the following remarks on them:—

These fine skins were sent to me by Captain Richard Crawshay, F.Z.S., who shot them at Piet Retief, Transvaal, and at his request are going to the National Collection. Captain Crawshay writes that these birds, although very common at Piet Retief, are extremely wary and cunning, but if taken unawares may be approached by moving round them in lessening circles. At sunrise and sunset their sonorous call "chakwaka; kwaka" may be heard on all sides, but the birds themselves are seldom seen and are silent by day and night. Captain Crawshay observed that the feet and bills of the birds had a strong odour of formic acid, and he believes from examination of the contents of the stomachs that they feed largely on termites and red ants. I have myself carefully examined the stomachs of two specimens which he was kind enough to send me. That of one specimen was full of Indian corn, with remains of some pointed leaves, and a number of broken fragments of large, yellowish-red ants. The stomach of the other specimen was filled by a brown mass of about the appearance and consistency of shag tobacco, and was composed of vegetable fibres with innumerable fragments of small ants and some pieces of the integument of beetles.

I have compared these skins carefully with the small collection at the Natural History Museum. There is a good deal of variation in the coloration of adult males. In most of the specimens the cinnamon-brown of the back of the neck is continued some little way between the shoulders, but in one specimen the dusky colour extends to the beginning of the neck. The webs of some of the inner primaries are white rather than yellow. *T. barrovii* appears to be closely similar to *T. senegalensis*. In the British Museum Catalogue of Birds (vol. xxiii. 1894, pp. 310-312) there is some confusion as to the colouring of the inner primaries of *T. senegalensis*, which, in the description of that bird, are correctly stated to have white or pale tawny on the inner webs, while later, in the description of *T. barrovii*, it is stated that "some of the inner primaries are marked with sandy colour at the base of the inner web, whereas they are entirely black in *T. senegalensis*." In the specimens of both species that I have examined, the colouring of these feathers is alike, white or pale tawny on the inner webs. It is given as a specific distinction, that in *T. barrovii* the tail-feathers are devoid of the second band of black across the dorsal surface. These feathers vary in *T. barrovii*; in one of my specimens the feathers have the broad black tip and a second band of black higher up, precisely as in

T. senegalensis. Another distinction made is that in *T. barrovii* the sandy rufous of the back of the neck is carried up to the head without the intervening shade of grey found in *T. senegalensis*. The intervening shade of grey occurs in a specimen of a young male of *T. barrovii*, and in my two specimens of that bird, which appear to be adult, there are traces of it. The two species, however, are easy to separate. *T. senegalensis* is much paler in colour, especially on the back, and in *T. barrovii* the patch of black on the throat is larger than in *T. senegalensis* and runs up in a point towards the chin.

Mr. R. I. Pocock, the Superintendent of the Gardens, exhibited two photographs (one of which is shown in text-fig. 1), kindly taken by Mr. J. ffolliott Darling, F.Z.S., of a young hybrid Waterbuck

Text-fig. 1.

Hybrid Waterbuck between *Kobus defassa unctuosus* ♂ and *K. ellipsiprymnus* ♀. Nearly 3 months old.

between *Kobus defassa unctuosus* ♂ and *Kobus ellipsiprymnus* ♀, bred in the Society's Gardens. The period of gestation of the female was carefully recorded by H. Munro, the keeper in charge of the Antelopes, and proved to be nine months and ten days, extending from January 14th to October 24th, 1903. The young animal therefore was not quite three months old at the time of writing. In general colour it favoured the dam rather than the sire, being decidedly less rufous in tint than the latter, although not so grizzly black as the former. There was, however, practically no trace of the white elliptical rump-mark so characteristic of *K. ellipsiprymnus*, which indicated reversion to the ancestral type of colour.

Mr. Oldfield Thomas, F.R.S., exhibited the skin and skull of a Gazelle (text-fig. 2), which had been obtained by Mr. A. E. Butter during his recent expedition into North-east Africa.

Text-fig. 2.

Skull and horns of *Gazella soemmerringii butteri*, subsp. nov.

The Gazelle was a member of the *Gazella soemmerringii* group, but was distinguished externally from true *soemmerringii* and *G. s. berberana* by its smaller size, and the presence of a distinct

pygal black band, this band being represented in those animals only by a scarcely perceptible darkening. The black facial bands were unusually strong and sharply defined, that running through the eye being considerably more developed than in the other forms. There was also a very faint trace of a dark lateral band. The fur of the neck from the withers to halfway up the neck was reversed forwards along the middle line.

The skull was conspicuously smaller than in either of the two allied subspecies, but was generally similar in details. The horns had the type of curvature characteristic of the true Abyssinian *soemmerringii*, but were thinner, longer in proportion to the size of the skull, their basal, parallel portion was longer, and they were less widely expanded above, as shown in the figure; the tips were very abruptly curved inwards.

The measurements of the skull and horns were as follows:—

Skull: greatest length 219 mm., basal length 198, greatest breadth 98; muzzle to orbit 118; nasals 57 × 24; nasal opening 61 × 25; gnathion to front of anterior premolar 55; length of upper tooth-series 65.

Horns: length round curves on front and inner aspect 333 mm. (13·1 in.); circumference at base 120.

Equally adult skulls of *soemmerringii* and *berberana* were about 220 mm. in basal length.

The habitat was south of the Daua River, in the Boran country, about 5° N. lat.

Mr. Thomas considered that this Gazelle represented a new subspecies of *G. soemmerringii*, and proposed to name it *G. s. butteri* in honour of its discoverer, by whom the type specimen had been presented to the National Museum (B. M. No. 4.1.20.1).

Mr. Macleod Yearsley, F.R.C.S., F.Z.S., exhibited an aneurysm of the abdominal aorta from a Jaguar and photographs of one in a Turtle. Both specimens were in the College of Surgeons' Museum, the latter being Hunterian. The aorta in the case of the Jaguar was extensively atheromatous. The following are the descriptions of the specimens:—

"3212. The abdominal aorta of a Jaguar (presented to the Royal College of Surgeons by the Council of the Zoological Society of London), of which a small portion of the wall is dilated into a spheroidal aneurysmal sac, about two inches in its chief diameter. The sac is nearly full of firm laminated coagulum. Around its mouth, and in isolated patches on several other parts of the artery, the internal coat appears slightly thickened, and there are deposits, probably of fatty matter, beneath it. Over many of these deposits, also, small portions of the inner coat have been removed, leaving smooth-edged apertures like ulcers, some of which are very close-set, and give the remains of the internal coat in some parts an irregular reticulated appearance. Wherever this disease has made much progress the artery is slightly dilated.

"3150. The aorta of a Turtle (photographed from a specimen in the Hunterian Collection, Royal College of Surgeons), in which, without any obvious morbid change of structure, a small conical aneurysm is formed by dilation of a portion of all the coats. The base of the cone is formed by the mouth of the aneurysm, and one of its borders projects a little, like a narrow semilunar valve."

The following papers were read :—

1. A Monograph of the Coleoptera of the Genus *Hipporrhinus*, Schh. (Curculionidæ). By GUY A. K. MARSHALL, F.Z.S.

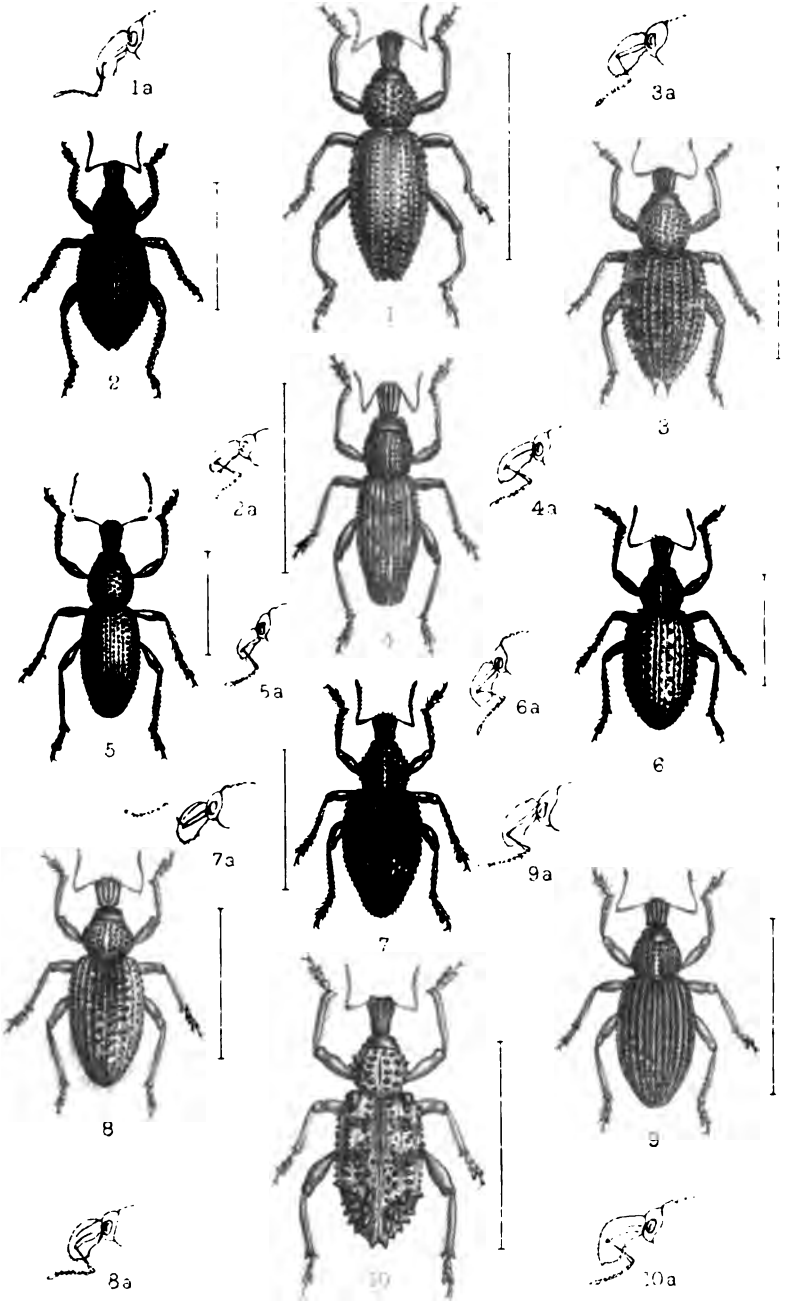
[Received November 12, 1903.]

(Plates I.–IV.*)

Since the time, now more than thirty years ago, when Fåhræus described the collections made by the Swedish surveyor and explorer, Wahlberg, the Curculionidæ of South Africa have received comparatively little attention from systematists, and, so far as the genus *Hipporrhinus* is concerned, only a bare half-dozen isolated species have been described by Péringuey, Faust, and Fairmaire during that period. As a result of this a considerable amount of undescribed material has accumulated in collections, so that I have found it necessary to recognise provisionally no less than fifty new species, the describing of which has necessitated a complete revision of the genus. For much of this material I am indebted to the liberality of my fellow-entomologists in South Africa, and especially to the Rev. Father O'Neil, of Dunbrody, near Uitenhage; Dr. H. Brauns, of Willowmore, Cape Colony; and Mr. C. N. Barker, of Natal; all of whom have generously presented me with examples of any species I required from their collections. During a few days' stay in Cape Town I was able to look through the fine series of *Hipporrhini* in the South African Museum and also in Mr. Péringuey's private cabinet. The latter gentleman not only placed all his material at my disposal, but kindly handed over to me his MS. of a monograph of the genus which he had begun to write in French many years ago. Although I have not been able altogether to accept the arrangement and subdivision of the genus proposed by Mr. Péringuey, yet I have availed myself of several interesting notes and observations made by him, and have adopted one of his proposed new genera.

A great part of my work was effected in the Insect Room of the British Museum during the summer of 1902, and I have to gratefully acknowledge the courteous assistance afforded me by both Mr. C. J. Gahan and Mr. G. J. Arrow during the many

* For explanation of the Plates, see p. 141.



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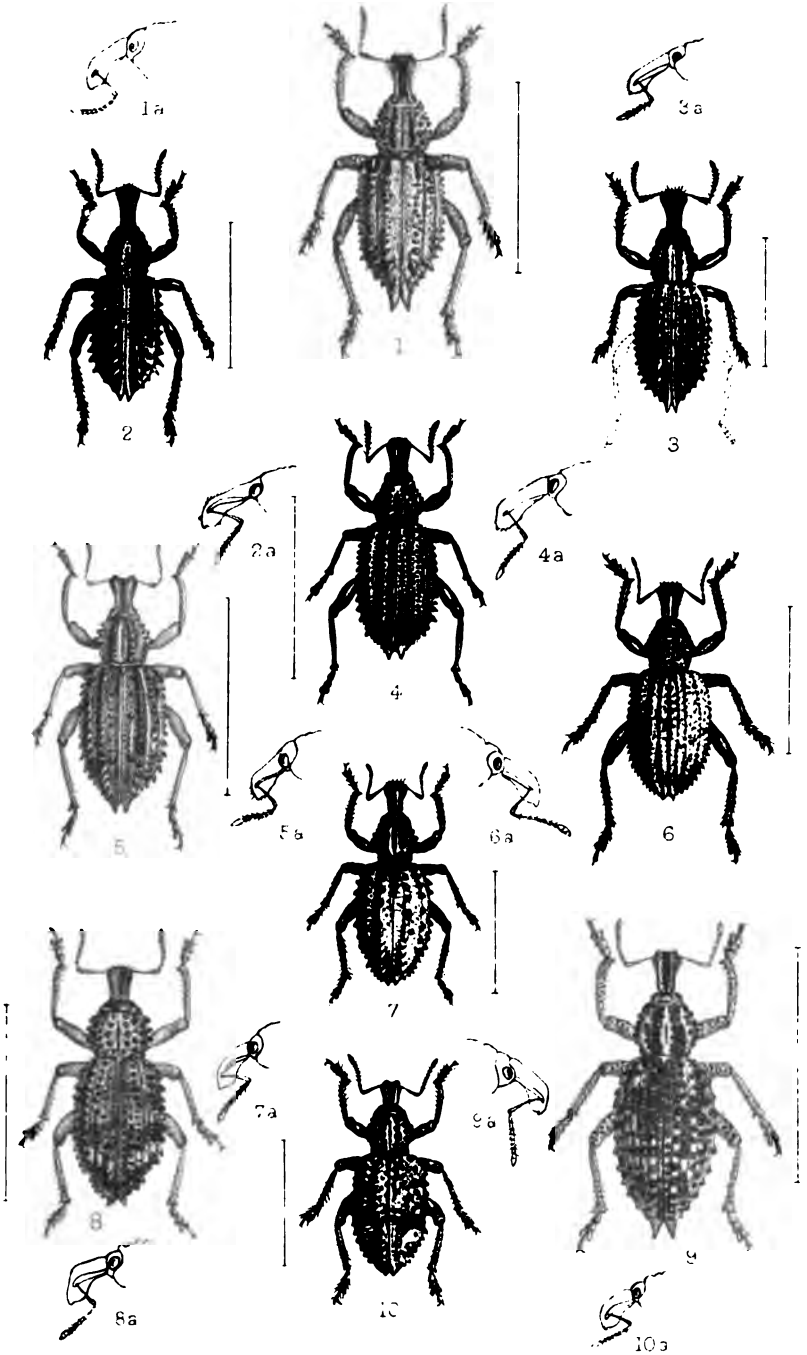

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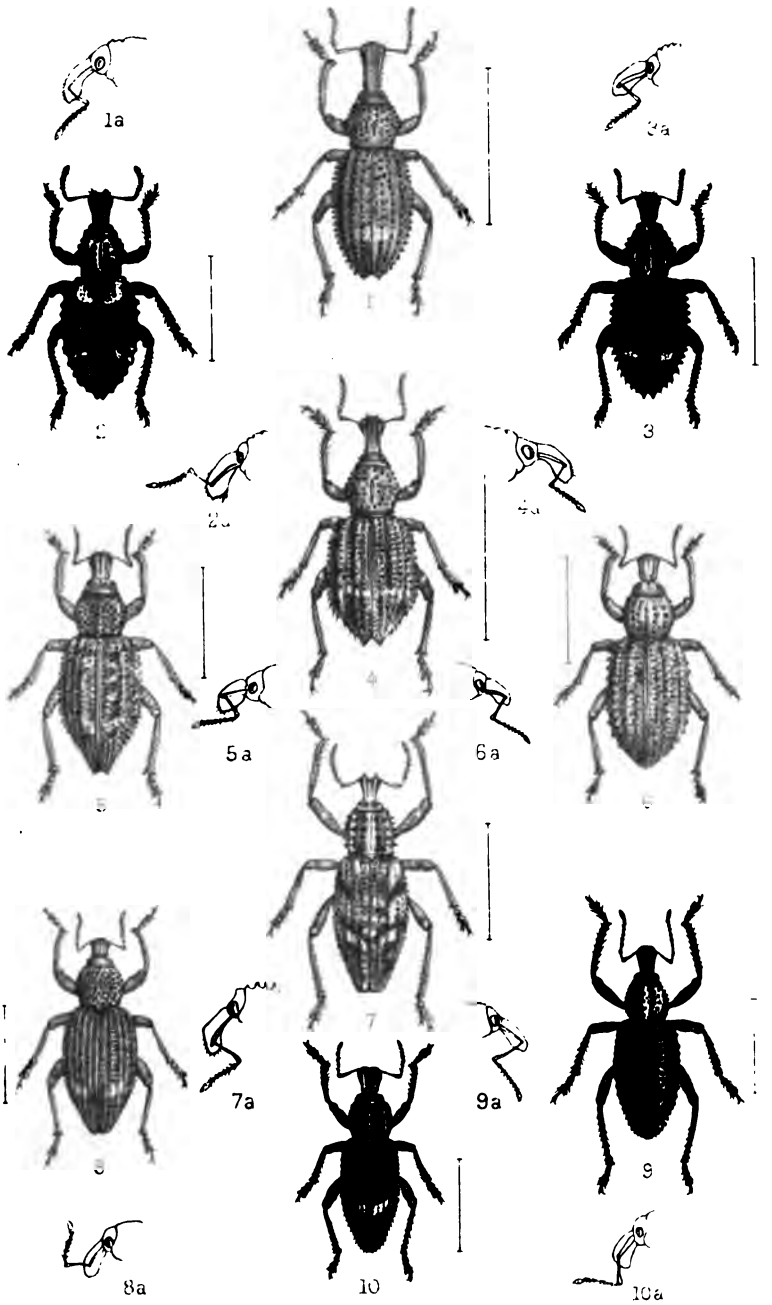

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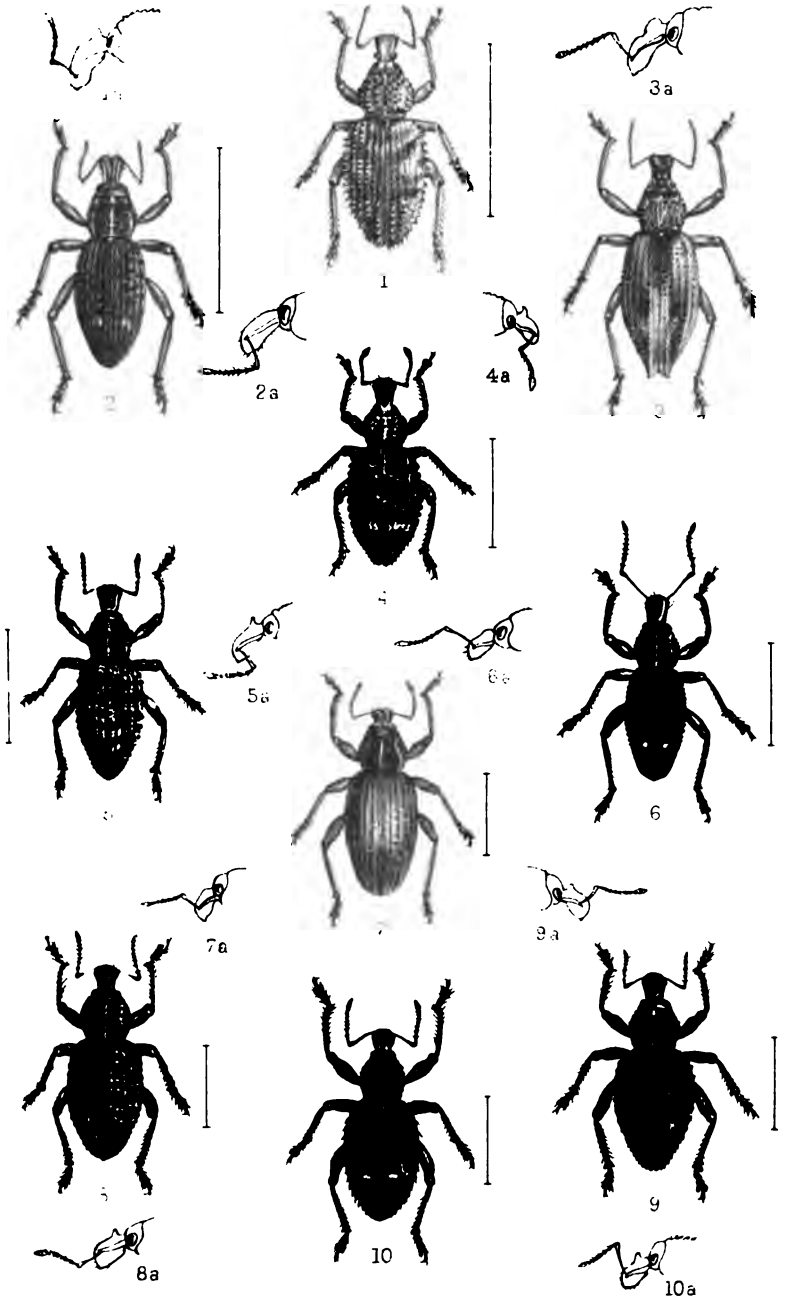

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COLEOPTERA OF THE GENUS HIPPORRHINUS

hours which I spent there. During a stay in Oxford, my kind friend Prof. Poulton gave me the freest access to the valuable collections in the Hope Department, which resulted in the discovery of a number of the missing Schönherrian types of Curculionidæ, including one *Hipporrhinus*, the rare *H. capicola* Gyl. The present paper, however, was only rendered possible by my visit to Stockholm, where, through the kindness of Profs. Aurivillius and Sjöstedt, I was able thoroughly to study the original collections of Schönherr and Chevrolat, as well as all Fåhræus' types in the general Museum collection.

I have personally examined examples of all the species described in this paper, with the exception of four only; although it is quite possible that in the case of some of Gyllenhal's species, the types of which have been lost, my identification from the description only may eventually prove to be incorrect. The four species referred to are *carinirostris* Gyl., *sublineatus* Gyl., *coronatus* Fst., and *quadrispinosus* F. Possibly the last species does not belong to the genus at all, for Fabricius' description is useless for the purpose of identification. Wherever it has been possible—and this was fortunately so in the great majority of cases—the type specimens have been examined; but unfortunately in the case of the collections made by Ecklon & Zeyher and by Drège, Schönherr appears to have returned a number of his types to the collectors. The whereabouts of these types I have so far failed to trace. Mr. Péringuey kindly lent me for examination a printed price-list, issued by Ecklon & Zeyher, of all their South African insects, from which I inferred that their collection was distributed piecemeal in many directions. Mr. Péringuey further says that when he first came to the South African Museum that Institution possessed a series of named Coleoptera presented by these collectors, but the insects were so damaged by *Anthreni &c.* that they could not be preserved. It is possible that some of the types were destroyed among them. A son of Drège, the botanist, is now living in Port Elizabeth, but he informed me that he had no remembrance of his father's collections beyond that they had been sold by auction by Thorey either in Altona or Hamburg. Provided the labels have not been removed, the missing types might yet be recognised, for Schönherr appears to have labelled all the specimens which he returned to his correspondents. This is only one example of the great disadvantage of the tendency to hoard up type specimens in private collections, which are, for the most part, liable to be dispersed upon the death of their owners; the disappearance of the types often resulting in endless confusion and unnecessary labour for future workers. One could almost wish that it might be possible to render it obligatory for the type, or at least a co-type, of every species described in England to be placed in the National Collection, in order to insure its accessibility to all students. In the Coleoptera especially, the immense increase every year in the number of described species should emphasise the importance of attempting to simplify future

Species.	Angola.	Cape Col. West.	Cape Col. East.	Natal.	Transvaal.	Orange River Colony.	Rhodesia	E. Africa N. of Zambesi.
appendiculatus	...	*	*					
cornirostris	...	*	*					
verrucosus	...	*						
oaxus	...	*?						
rugirostris	...	*						
serienodosus	...	*						
seriatus	...	*?						
caffer	...	*						
quadrilineatus	...	*						
setulosus	...	*?						
gravidus	...	*						
verrucellus	...	*?						
obesus	...	*?						
congestus	...	*						
namaquus	...	*						
subcordatus	...	*?						
albicinctus	...	*						
janus	...	*?						
corpulentus	...	*						
curtus	...	*						
inflatus	...	*						
bituberculatus	...	*	*					
angustus	...	...	*					
capensis	...	*						
péringueyi	...	*						
lacunosus	...	*?						
criniger	...	*?						
deceptor	...	...	*					
sparsus	...	*?						
suturalis	...	*?						
granulatus	...	*?						
granulosus	..	*						
aurivilii	..	...	...	...	*			
severus	...	...	...	*	*	*		
pilularius	...	*	*					
furvus	...	...	*	*	*	*	*	
tenuegranosus	...	...	...	...	...	...	...	*
spectrum	...	...	*					
abruptecostatus	...	*?						
spinifer	...	*						
humeralis	...	*						
nestor	...	*?						
nodulosus	...	*						
occidentalis	...	*?						
fictilis	...	*?						
canaliculatus	...	*?						
horni	...	*?						
rubifer	...	*						
eckloni	...	...	*					
bohemanii	..	...	...	...	*	*	*	
chirindensis	..	...	...	...	...	...	*	
caudatus	...	...	...	*				
scaber	...	...	*?					
tricostatus	...	...	*?					
ferus	...	...	*					
mammillatus	...	...	*					
lobatus	...	*						
sulcirostris	...	...	...	*	*			
recurvus	...	*						
albolineatus	...	*						
gyllenhali	...	*						
nivosus	...	*						
maculatus	...	*?						
globifer	...	*						
spiculosus	...	*						
insignis	...	*						
vafer	...	*						
knysna	...	*						

Species.	Angola.	Cape Col. West.	Cape Col. East.	Natal.	Transvaal.	Orange River Colony.	Rhodesia	E. Africa N. of Zambesi.
sexvittatus	...	*						
transvaalensis	...	...	...	...	*			
delectans	..	...	*					
nyassæ	...	...	...	...	...	...	...	*
angolensis	*	..						
ovampoensis	*	...						
asper	...	...	...	*	*			
wahlbergi	..	...	...	*	*			
serratus	...	...	...	...	*			
deplorabundus	...	...	...	...	*			
spinicollis	...	...	*					
crispatus	...	*?						
infacetus	...	*						
frontalis	...	*	*					
tuberosus	...	*?						
pilosus	...	*						
thoracicus	..	*?						
aculeatus	...	...	*					
seriespinosus	...	...	*					
affinis	...	..	...	*	*	*	*	
fallax	...	...	...	...	*?			
binodis	...	...	*	*				
quadrinodis	...	...	*	*				
braunsi	...	...	...	...	...	*		
errans	...	...	...	*				
squalidus	...	...	*					
modestus	...	...	...	...	*			
granatus	...	*?						
partitus	...	*?						
permixtus	...	...	...	...	*			
albicans	...	...	...	*				
cinereus	...	...	*?					
capicola	...	*?						
setiferus	...	*?						
pilifer	...	...	*					
laticeps	...	...	*					
gunningi	..	...	...	...	*			
constrictus	...	...	*					
incisirostris	...	*?						
dregei	...	*						
brachyceroides	...	*						
armatus	...	...	...	*				
monitor	...	...	...	...	*			
nasutus	...	...	...	...	...	*		
coronatus	..	...	...	...	*			
consors	...	...	...	...	*			
corniculatus	...	...	...	...	*	*	*	
propinquus	...	...	...	...	...	...	*	
bimaculatus	...	...	...	...	...	...	*	
cervinus	...	...	...	...	*	*		
talpa	...	...	...	...	*	...	*	
vicinus	..	...	...	*				
brevis	..	...	*?					
incertus	..	...	...	...	...	...	*	
arenarius	...	...	...	..	..	...	*	
seriegranosus	...	*?						
longulus	...	*?						
sjöstedti	...	*						
porculus	...	*?						
granicollis	...	*	*					
varius	...	...	...	*	*	...	*	
o'neili	..	...	...	*				
vittatus	...	...	...	..	*?			
sublineatus	...	...	*?					
subvittatus	...	...	...	*	*			
dolorosus	...	...	...	*				
Totals	2	71	28	17	24	8	11	2

systematic work by the centralisation of type specimens; and every truly scientific systematist should recognise his moral obligation to assist in achieving this end.

The genus *Hipporrhinus*, as here defined, comprises 138 species, which vary very considerably both in size and general facies, as might be anticipated in the case of a widely distributed genus of wingless and slow-moving insects. Lacordaire was of the opinion that the genus could not remain as constituted by Schönherr, but would have to be subdivided. He laid special emphasis on the differences in the development of the ocular lobes of the prothorax, the length of the scape, and the length and sculpture of the rostrum; but, on the other hand, he admitted that he had seen very few of the smaller species described by Gyllenhal. Had he been acquainted with a larger number of species he would probably have modified his opinion, for the differences upon which he relied will be found to merge so much one into another as to make it very difficult to draw a satisfactory dividing line anywhere. Even so important a character as the direction of the scrobe can scarcely be regarded here as of generic value, owing to the manner in which the various forms tend to grade off into each other; or, again, different types may be found in species otherwise very closely allied, as, for example, in *crispatus* F. and *infacetus* Gyl. It is often contended that the erection of genera in such cases facilitates classification; but this can only be the case if the resulting groups are homogeneous in appearance and distinguished at least by some well-defined superficial character. It can only be hoped that, despite its obvious shortcomings, the synoptic key supplied herewith will sufficiently assist identification as to atone for the retention of so large and variable a genus.

Taking as a starting point the tribe Hipporrhinides as proposed by Lacordaire, it may conveniently be divided into the following genera :—

1. (2). Prothorax without ocular lobes; eyes small, round, and prominent ..... *Cyclomus* Schh.
2. (1). Prothorax with ocular lobes; these lobes are occasionally considerably reduced, but in these cases the eyes are large, elongate, and subdepressed.
3. (4). Eyes short oval ..... *Epichthonius* Schh.
4. (3). Eyes elongate, acuminate below.
5. (6). Upper edge of eye elevated above the level of the forehead. **Origenes*, gen. nov.
   (Type, *Hipporrhinus callidus* Gyl.)
6. (5). Upper edge of eye not elevated.
7. (8). Rostrum always more or less dilated at apex. First joint of funicle subcylindrical, not broader than second. Mandibles dissimilar, the left usually larger and broadly overlapping the right, the apices broadly rounded when closed..... *Hipporrhinus* Schh.

8. (7). Genæ compressed; rostrum never dilated at apex, parallel-sided, or even slightly subulate. Mandibles equal in size, of almost similar shape, scarcely overlapping when closed and the united tips sharply acuminate. First joint of funicle subcompressed, distinctly broader than second when viewed laterally..... **Stramia*, gen. nov. (Type, *Tanyrrhynchus costirostris* Boh.)

Of the above-named five genera the first three are confined entirely to the Cape Colony. *Stramia* occurs in Natal, Orange River Colony, and the Eastern districts of Cape Colony; it probably will be found also in the Transvaal, but it does not yet extend north of the tropic. *Hipporrhinus* has a much wider range, extending on the eastern side of the continent from Natal to Abyssinia, and on the west from Cape Town to Angola. But it is in the Cape Colony that the genus attains its greatest development, and it appears to flourish even in the most arid districts; indeed it is noticeable that these insects steadily diminish the nearer we approach the heavier rainfall and more luxuriant growth of the eastern littoral, and it is only along the higher plateaux that the genus penetrates into the tropics.

The Table on pp. 8 & 9 will give a good idea of the general distribution of the genus. Unfortunately in all the older collections the specimens, if labelled at all, merely bear the vague locality "Cape of Good Hope" or "Caffraria." In the case of the Cape Colony species given in the table, there is little doubt that they were all captured within that area, the only uncertainty being whether they are from the Eastern or Western Districts. In order to make the table more complete, I have ventured on an opinion in these doubtful cases, all of which are marked with a ?.

Upon analysing the figures shown above, we can more clearly perceive the distributional relationship existing between the various areas, which may best be shown in tabular form.

District.	Species peculiar to the District.	Species occurring also in C. Col. West.	Species occurring also in C. Col. East.	Species occurring also in Natal.	Species occurring also in Transvaal.	Species occurring also in Orange Col.	Species occurring also in Rhodesia.
Cape Colony, West	65	(71)	6				
„ East	19	6	(28)	3	1	1	1
Natal	7	...	3	(17)	8	3	3
Transvaal	12	...	1	8	(24)	6	6
Orange River Colony	2	...	1	3	6	(8)	4
Rhodesia	5	...	1	3	6	4	(11)
Angola	2						
Central East Africa.	2						

* For description see Appendix.

The most striking point in connection with these figures is the marked isolation of the south-western insect fauna as compared with that of the rest of the sub-continent. Of the 93 species of *Hipporrhinus* occurring in the Cape Colony, only three are at present known to exceed its limits. Of these one is the most wide-ranging S. African species, *furvus*. The others are *quadrinodis*, of which I have seen only a single example from Natal; and *binodis*, a littoral species which extends from Algoa Bay along the Natal coast and up to Delagoa Bay. The insect fauna of the Orange River Colony is at present so little known, that the figures in the above-given table can give no true idea of the occurrence of *Hipporrhinus* in that region; but it seems probable that the genus has extended from its original headquarters in the south-west through that Colony into the Transvaal, rather than through the forest-regions of the Transkei, Pondoland, and Natal. It must be noted, however, that nothing whatever is known at present of the Curculionidæ of Basutoland or Griqualand East.

This presumed migration of the genus is supported by the gradual diminution of the species northwards, and also by the fact that the only two which occur to the north of the Zambesi, viz. *tenuegranosus* and *nyasæ*, are clearly only modified forms of common South African species, viz. *furvus* and *asper* respectively. The progenitors of the two former species probably extended their range at a time when the mountainous backbone of Eastern Africa was more continuous than it is today, for within the tropics the genus does not appear to exist below the 3000 ft. level. From Natal and the Transvaal the northward movement has probably taken place along the eastern face of the inland plateau, for the insects of Umtali (3700 ft.) show many affinities with the fauna of those Colonies which are not observable at Salisbury, only 175 miles north-west of it. At present only five species of *Hipporrhinus* have been found at Umtali; of these only two occur also at Salisbury, whereas no less than four out of the five are Transvaal species. So far as the coastal belt is concerned, Delagoa Bay is the most northerly point from which the genus has been recorded, and it is doubtful whether it extends very much further; for it is certainly absent from Beira, $3\frac{1}{2}^{\circ}$ within the tropic, where Mr. P. A. Sheppard has been carefully collecting Coleoptera for some years past.

The southern origin of *Hipporrhinus* further receives interesting confirmation from the fact that some of its nearest allies are to be found in Australia. Indeed in the case of certain species of the genus *Leptops*, so close is the general resemblance to *Hipporrhinus* that they are frequently included in the latter genus in collections. However, the nearly allied South African Somatotides show an even closer structural affinity with the Amycterides of Australia. The existence, in past geological epochs, of some land connection between South Africa and Australia is rendered highly probable by the occurrence of similar affinities in widely different orders of animals and plants, which cannot be satisfactorily

explained on the supposition of a common northern origin. We have therefore some grounds for supposing that the genus *Hipporrhinus* has been originally derived from an Australian stock.

The beetles of this genus are heavy, slow-moving insects, and a large number of them are practically terrestrial in their habits, feeding on low plants or herbs and readily falling to the ground when disturbed. Many of the larger species, however, such as *severus*, *furvus*, *spectrum*, *sulcirostris*, &c., are arboreal, possibly because their larger size would render them too conspicuous on small plants. The colouring of all the species with which I am acquainted in the field is certainly procryptic, and this is probably true for the whole genus. Although the elytra of the larger species are not nearly so hard as those of *Brachycerus*, the hardness and conical tubercles of these forms doubtless afford them an efficient protection against the smaller insectivorous animals.

Nothing whatever appears to be known of the earlier stages of the genus.

HIPPORRHINUS Schh.

Head convex on the vertex, forehead often flattened, occasionally excavate; eyes large, elongate, transverse and depressed, often separated from the rostrum by a lateral furrow of variable depth.

Rostrum very variable, longer than the head, stout, curved, more or less dilated apically and increasing in depth from base to apex, deeply furrowed, costate or carinate, sometimes with a stout tubercular prominence at base; scrobes either directed to beneath the base of the rostrum, in which case they are always deep, or entirely lateral in position, when they may be either straight, oblique or sinuate, and are sometimes shallow. The under surface is usually separated from the head by a more or less pronounced transverse basal furrow, which can best be observed by examining the rostrum in profile.

Antennæ inserted close to apex, moderately long and stout; scape gradually clavate, usually reaching the anterior margin of eye, but often shorter and occasionally exceeding its posterior margin; funicle with the two basal joints elongate and usually equal, the remaining joints short, equal, or gradually diminishing apically; club oval, acuminate and articulate.

Prothorax transverse, with its sides rounded, sometimes angulated or even armed with a stout spine, the basal margin truncate, apical margin truncate, convex or concave; ocular lobes rounded, moderately prominent, but occasionally much reduced; the upper surface more or less closely set with tubercles or granules.

Elytra ovate or oblongo-ovate, convex, sharply declivous posteriorly, soldered together at the suture and without wings beneath, punctato- or granulato-striate, all the intervals, or at least the alternate ones, with regular rows of tubercles or granules; apices of the elytra often separately produced, sometimes in both sexes, but usually more so in the female than in the male.

Abdomen with the second segment shorter than the third and fourth together and separated from the first by a faint curved incision, the remaining incisions deep and straight, the intercoxal piece broad and truncate; metasternum very short.

Legs moderately long; femora clavate, the posterior pair not nearly reaching the apex of the elytra; the anterior and intermediate tibiæ with their internal apical angles strongly incurved, the anterior pair with their inner edges always, the posterior pairs frequently, denticulate; tarsi usually broad and spongy beneath, the first joint nearly always longer than the second or third, very rarely longer than these two together, the second and third joints generally equal; the three basal joints usually of about the same width, but the third strongly lobate and sometimes broader than the others; claws moderate, simple, and free; anterior coxæ contiguous, intermediate pair nearly so.

To prevent misunderstanding, it may be explained that in describing the sculpturing of the elytra the space between the suture and the first stria is called the first interval. This system was adopted by Gyllenhal in his earlier descriptions (e. g. *pastillarius*), but in his later work he calls this interval the suture, and the next interval the first; in this he is followed by Fåhræus.

Synoptic Key to the Genus HIPPORRHINUS.

1.	(64.)	Rostrum cut off from head by a very deep transverse dorsal incision at base.
2.	(5.)	Rostrum with a stout basal tubercle.
3.	(4.)	Rows of granules on intervals 2 and 4 of the elytra ceasing abruptly before apex ..... 1. *H. appendiculatus* Gyl.
4.	(3.)	Rows of granules on intervals 2 and 4 uniformly continuous to apex ..... 2. *H. cornirostris* Gyl.
5.	(2.)	Rostrum without a basal tubercle.
6.	(11.)	Body with a distinct metallic bronze reflexion; hind tibiæ of ♂ very strongly curved below middle.
7.	(8.)	Rostrum with a deep central furrow; the lower lateral sulcus on the rostrum distinctly shorter than the upper ..... 3. *H. verrucosus* L.
8.	(7.)	Rostrum without a central furrow; the lower lateral sulcus as long as, or longer than, the upper.
9.	(10.)	Basal half of rostrum shiny, with scattered fine punctuation; the second joint of funicle longer than first in the ♂ ..... 4. *H. oaxus* Mshl.
10.	(9.)	Rostrum rugosely punctured throughout; the two basal joints of funicle in ♂ equal, or with the first slightly longer ..... 5. *H. rugirostris* Gyl.
11.	(6.)	Body black; hind tibiæ of ♂ normal.
12.	(19.)	Intervals 2 and 4 on elytra without granules or tubercles.
13.	(16.)	Intervals 3 and 5 tuberculate, at least towards apex.
14.	(15.)	Intervals 3, 5, and 7 with remote tubercles throughout. 6. *H. sericeodosus* Gyl.
15.	(14.)	Intervals 3, 5, and 7 with undulating costæ anteriorly but tuberculate towards apex ..... 7. *H. seriatus* Gyl.
16.	(13.)	Intervals 3 and 5 devoid of tubercles, but strongly carinate.
17.	(18.)	Intervals 2, 4, and 6 narrow, subcostate, and with very sparse pale scaling; punctures on elytra ocellated. 8. *H. caffer* Thunb.

18. (17.) Intervals 2, 4, and 6 broad, quite plane, and with dense white or ochreous scaling; punctures on elytra not ocellated ..... 9. *H. quadrilineatus* Gyl.
19. (12.) Intervals 2 and 4 on elytra granulate.
20. (23.) Interval 3 with large conical tubercles at least from middle to apex.
21. (22.) Rostrum with a central carina; elytra without true scales, but with recumbent pale setæ. 10. *H. setulosus* Gyl.
22. (21.) Rostrum without a central carina; elytra with scattered large round whitish scales ..... 11. *H. gravidus*, sp. nov.
23. (20.) Interval 3 evenly granulate throughout, or at most with a single tubercular prominence on or near the declivity.
24. (33.) Rostrum without a central carina.
25. (32.) Elytra broadly ovate, not transversely rugose, but with regular rows of granules or small closely-set punctures.
26. (29.) Elytra distinctly sulcate; sulci granulate.
27. (28.) Forehead longitudinally rugose ..... 12. *H. verrucellus* Gyl.
28. (27.) Forehead with two distinct foveæ separated by a narrow carina ..... 13. *H. obesus* Gyl.
29. (26.) Elytra not sulcate, densely, regularly and evenly tuberculate throughout, with small rounded tubercles.
30. (31.) Interval 3 with a distinct tubercular prominence on the declivity; forehead not impressed. 14. *H. congestus* Mshl.
31. (30.) Interval 3 without any prominence; forehead with two longitudinal impressions ..... 15. *H. namaquus*, sp. nov.
32. (25.) Elytra heart-shaped, transversely rugose, and with rows of large and remote, but indistinct foveolæ. 16. *H. subcordatus* Gyl.
33. (24.) Rostrum with a distinct central carina.
34. (63.) Rostrum not very short, much longer than head.
35. (60.) Scales on elytra normal, round or ovate.
36. (45.) Posterior tibiæ strongly dentate interiorly.
37. (38.) Shoulders of elytra with a tubercular projection; interval 3 with a large granulate prominence on the declivity ..... 17. *H. albicinctus* Gyl.
38. (37.) Shoulders of elytra simple; interval 3 without prominence.
39. (40.) Each elytron produced at apex into a very long sharp spine ..... 18. *H. janus* Mshl.
40. (39.) Apices of elytra at most with a small tubercle.
41. (42.) Sulci on elytra indistinct, being filled with rows of large granules, making the elytra to appear evenly granulate all over ..... 19. *H. corpulentus* Gyl.
42. (41.) Sulci on elytra distinct, containing only very minute granules.
43. (44.) Prothorax large, globose, only slightly narrower than the elytra at shoulders ..... 20. *H. curtus* Gyl.
44. (43.) Prothorax exceptionally small in proportion, only about half as wide as the elytra at shoulders. 21. *H. inflatus*, sp. nov.
45. (36.) Posterior tibiæ scarcely dentate interiorly.
46. (49.) Interval 3 on the elytra with a more or less distinct solitary tubercle at the summit of the declivity.
47. (48.) Prothorax with a distinct constriction near apex, the sides very strongly rounded ..... 22. *H. bituberculatus* Gyl.
48. (47.) Prothorax not constricted apically, the sides only moderately rounded ..... 23. *H. angustus*, sp. nov.
49. (46.) Interval 3 without any solitary larger tubercle.
50. (53.) Inflexed margins of elytra not markedly differentiated from the dorsal part, the scaling and granulation similar.
51. (52.) Elytra with a low, tuberculate, intra-apical callus on each side; anterior tibiæ of ♂ distinctly sinuate externally ..... 25. *H. péringueyi*, sp. nov.
52. (51.) Elytra without any intra-apical callus; anterior tibiæ of ♂ not sinuate externally ..... 24. *H. capensis* L.

53. (50.) Inflexed margins of elytra markedly differentiated from the dorsal part, the intervals being plane and almost devoid of scaling or granulation.
54. (59.) All granules or tubercles on elytra with short pale depressed setæ.
55. (58.) The two basal joints of funicle subequal.
56. (57.) Upper surface of rostrum almost plane, the central furrow narrow and vanishing before middle. 29. *H. sparsus* Mshl.
57. (56.) Upper surface of rostrum distinctly sulcate, the central furrow strong and complete ..... 28. *H. deceptor* Mshl.
58. (55.) First joint of the funicle longer than second. 26. *H. lacunosus* Gyl.
59. (54.) Tubercles on intervals 1, 3, and 5 with very long erect black setæ ..... 27. *H. criniger* Mshl.
60. (35.) Scales on elytra very elongate, hair-like.
61. (62.) Intervals on elytra rugose, the granulation indistinct except near the sides; prothorax much less transverse ..... 30. *H. suturalis*, sp. nov.
62. (61.) Intervals on elytra distinctly granulate throughout; prothorax very transverse, its sides very strongly rounded ..... 31. *H. granulatus* Gyl.
63. (34.) Rostrum very short, only a little longer than the head ..... 32. *H. granulosus* Thunb.
64. (1.) Rostrum either continuous with head, or with its base raised above it, but never separated by a deep transverse dorsal incision.
65. (238.) Scape of antennæ not exceeding anterior margin of eye.
66. (219.) Rostrum without a basal tubercle.
67. (138.) Lateral sulci on rostrum not uniting at base.
68. (85.) Sides of prothorax with a distinct spine.
69. (84.) Rostrum separated from eye by a deep lateral furrow; size large.
70. (75.) Rostrum with only one lateral sulcus above scrobe.
71. (74.) Upper surface of rostrum with a deep central furrow; anteocular furrows not approaching above.
72. (73.) Elytra with rows of large subreticulate foveæ; the intervals narrow ..... 33. *H. auricilii* Pér.
73. (72.) Elytra with rows of small granules instead of punctures; the intervals broad ..... 34. *H. severus* Gyl.
74. (71.) Upper surface of rostrum plane or slightly convex; anteocular furrows strongly convergent above. 35. *H. variegatus*, sp. nov.
75. (70.) Rostrum with two lateral sulci above scrobe.
76. (81.) Row of tubercles on interval 2 of elytra complete.
77. (78.) Sides of prothorax strongly dilated and with a stout tuberculated spine ..... 36. *H. pilularius* F.
78. (77.) Sides of prothorax scarcely dilated and with a short simple spine.
79. (80.) Inferior basal furrow on rostrum distinct. 37. *H. furvus* Fåhr.
80. (79.) Inferior basal furrow on rostrum absent. 38. *H. tenuegranosus* Fairm.
81. (76.) Row of tubercles on interval 2 of elytra extending only from beyond middle to apex.
82. (83.) Dorsal part of elytral declivity strongly compressed laterally; 4th abdominal segment in ♀ with four sharp projections along its posterior edge. 40. *H. abruptecostatus* Gyl.
83. (82.) Dorsal part of elytral declivity not compressed; posterior edge of 4th abdominal segment simple in both sexes ..... 39. *H. spectrum* F.
84. (69.) Rostrum not separated from eye by a furrow; size small ..... 41. *H. spinifer* Gyl.
85. (68.) Sides of prothorax never with a distinct spine, usually rounded but sometimes angulated.
86. (93.) Elytra with a large boss-like tubercle at base of interval 5.
87. (90.) Prothorax without defined smooth lateral spaces.

88. (89.) Interval 2 with a row of conical tubercles from behind middle to apex; apical processes short. 42. *H. humeralis*, sp. nov.
89. (88.) Interval 2 with only a single large conical tubercle on the declivity; apical processes very long and sharp ..... 43. *H. nestor* Mshl.
90. (87.) Prothorax with a smooth defined space on each side of central furrow; interval 2 entirely devoid of tubercles.
91. (92.) Interval 5 with only two or three large distant conical tubercles in addition to the basal one; prothorax without a central carina ..... 44. *H. nodulosus* F.
92. (91.) Interval 5 with a row of seven or eight small closely-set tubercles behind the basal one; prothorax with a central carina ..... 45. *H. occidentalis* Mshl.
93. (86.) Elytra with shoulders normal.
94. (101.) Sides of prothorax angulated; the central furrow very broad and distinct, more or less dilated in middle.
95. (98.) Intervals 2, 4, and 6 entirely devoid of tubercles.
96. (97.) Rostrum without a central carina; tubercles on elytra large, separated and conical throughout. 46. *H. fictilis* Mshl.
97. (96.) Rostrum with a low central carina; tubercles on elytra from base to beyond middle small and agglomerated, the intervals costate ..... 48. *H. horni* Mshl.
98. (95.) Interval 2 always, interval 4 usually with a row of distant rounded tubercles.
99. (100.) Prothorax with a strong central carina. 47. *H. canaliculatus* Mshl.
100. (99.) Central carina on prothorax obsolescent. 49. *H. rubifer* F.
101. (94.) Sides of prothorax rounded, the central furrow narrow and much more shallow.
102. (107.) Intervals on elytra granulate, granules subequal throughout.
103. (106.) All intervals on elytra similar, subcostate and evenly granulate throughout.
104. (105.) Anteocular furrows not converging; rostrum contiguous dorsally with head throughout its breadth; apical processes of elytra very long ... 50. *H. ecklonî* Gyl.
105. (104.) Anteocular furrows converging so as to leave only a narrow dorsal ridge joining head and rostrum; apical processes short ..... 51. *H. bohemanii* Fåhr.
106. (103.) Intervals 4 and 6 not elevated and without any granules ..... 52. *H. ehirindensis* Mshl.
107. (102.) Intervals on elytra tuberculate, tubercles uneven; intervals dissimilar.
108. (131.) Transverse basal furrow on the underside of rostrum absent.
109. (122.) Dorsal anterior margin of prothorax lobate or convex.
110. (111.) Anteocular furrows distant, invisible from above. 67. *H. caudatus* Fåhr.
111. (110.) Anteocular furrows approaching, visible from above in the form of a more or less marked constriction at base of rostrum.
112. (115.) Lower lateral sulcus on rostrum obsolescent.
113. (114.) Prothorax with a broad horseshoe-shaped costa enclosing the central carina ..... 69. *H. tricostatus* Mshl.
114. (113.) Prothorax with large rounded tubercles on each side of the carina ..... 68. *H. scaber*, sp. nov.
115. (112.) Lower lateral sulcus on rostrum distinct.
116. (119.) Upper lateral sulcus on rostrum distinct.
117. (118.) Prothorax almost as long as broad, the tubercles large and subcristate; size smaller ..... 70. *H. ferus* Gyl.
118. (117.) Prothorax distinctly transverse, the tubercles small and evenly set; size larger ..... 71. *H. mammillatus* Gyl.
119. (116.) Upper lateral furrow on rostrum obsolescent.
120. (121.) Dorsal margins of rostrum strongly raised in the form of angulated carinæ; length 23 mm. 72. *H. lobatus* Mshl.
121. (120.) Dorsal margins rounded; length 14 mm. 73. *H. exilis*, sp. nov.
122. (109.) Dorsal anterior margin of prothorax truncate and not lobate.
123. (128.) Rostrum with a deep central furrow throughout.

124. (127.) Intervals 3 and 5 with the tubercles depressed and oval from base to declivity, thence conical; rostrum with a rounded impression at base.
125. (126.) Ocular lobes of prothorax only slightly developed; intervening granules in striæ minute, rows quite regular ..... 54. *H. recurvus* F.
126. (125.) Ocular lobes of prothorax well developed; intervening granules in striæ larger, the rows irregular and often confused ..... 55. *H. albolineatus* Fåhr.
127. (124.) Intervals 3 and 5 with the tubercles conical throughout; rostrum without a rounded impression at base; ocular lobes well developed ... 53. *H. sulcirostris* Fåhr.
128. (123.) Rostrum without a distinct continuous central furrow, at most very shallowly excavate.
129. (130.) Dorsal edges of rostrum rounded at base, carinate only near apex; rostrum with a central stria at base. 56. *H. gyllenhali* Gyl.
130. (129.) Dorsal edges of rostrum strongly carinate from base to apex; rostrum with no central stria at base. 58. *H. maculatus* Mshl.
131. (108.) Rostrum with a transverse basal furrow on the underside.
132. (133.) Dorsal edges of rostrum produced upwards into a sharp projection above the insertion of antennæ. 57. *H. nivosus* Sparrm.
133. (132.) Dorsal edges of rostrum without any sharp projection.
134. (135.) Elytra with irregular, and often confused, rows of large granules in lieu of punctures; legs with large round white scales ..... 61. *H. insignis* Fåhr.
135. (134.) Elytra with regular rows of minute granules; legs with narrow scales.
136. (137.) Intervals 3, 5, and 7 with rows of large separated tubercles which become very long, sharp and curved towards apex; legs with scattered narrow white scales ..... 60. *H. spiculosus* Gyl.
137. (136.) Intervals 3, 5, and 7 subcostate, with rows of small closely-set and often duplicated tubercles which become rather larger and conical towards apex; legs with brown setiform scaling..... 59. *H. globifer* F.
138. (67.) Either or both pairs of lateral sulci on rostrum uniting (or running into the central furrow) near the base, which is usually raised above the plane of the forehead.
139. (192.) Alternate intervals on the elytra uneven.
140. (167.) Scrobes directed beneath base of rostrum.
141. (154.) Inferior basal transverse furrow on rostrum absent.
142. (151.) Sides of prothorax not angulated but rounded.
143. (150.) Interval 2 tuberculate at least on the apical half.
144. (147.) Elytra with separated sharply conical tubercles, at least towards the sides and apex.
145. (146.) Dorsal edges of rostrum not carinate; prothorax fairly closely set with low rounded tubercles, its dorsal anterior margin truncate ..... 62. *H. vafer* Gyl.
146. (145.) Dorsal edges of rostrum strongly carinate; prothorax very sparsely set with large depressed tubercles, its dorsal anterior margin distinctly sinuate. 63. *H. knysna*, sp. nov.
147. (144.) Elytra without prominent conical tubercles, the alternate intervals subcostate and with small, closely-set, subcatenulate tubercles.
148. (149.) Ocular lobes well developed; eyes subdepressed; form robust ..... 65. *H. transvaalensis* Pér.
149. (148.) Ocular lobes feeble; eyes very prominent; form narrow ..... 64. *H. sexvittatus* F.
150. (143.) Interval 2 entirely devoid of tubercles. 66. *H. delectans* Hbst.
151. (142.) Sides of prothorax dilated and bluntly angulated.
152. (153.) Elytra oblongo-ovate, sides subparallel; the alternate intervals slightly carinate, but the tubercles distinctly separated ..... 74. *H. nyasæ*, sp. nov.

153. (152.) Elytra very short ovate, sides strongly rounded; the alternate intervals strongly carinate, the tubercles catenulate ..... 75. *H. angolensis*, sp. nov.
154. (141.) Inferior basal furrow on rostrum present.
155. (160.) Sides of prothorax angulated.
156. (157.) Anteocular furrows strongly convergent above; rostrum with a distinct basal callus on each side. 76. *H. ovampoensis* Pér.
157. (156.) Anteocular furrows not convergent above; rostrum without a basal callus.
158. (159.) Intervals 3, 5, and 7 on elytra not costate but with separate prominent tubercles; interval 2 with a short apical row of tubercles; forehead convex. 77. *H. asper* Mshl.
159. (158.) Intervals 3, 5, and 7 strongly costate and with rows of small closely-set tubercles; interval 2 quite plane; forehead broadly excavate ..... 78. *H. wahlbergi* Boh.
160. (155.) Sides of prothorax rounded.
161. (166.) Interval 2 with a short apical subcristate row of conical tubercles; rostrum finely punctured.
162. (165.) Rostrum without granules; prothorax set with irregular rounded or subconical tubercles.
163. (164.) Rostrum slightly convex at base and without any central furrow there; tubercles on interval 3 ceasing before declivity ..... 79. *H. serratus* Mshl.
164. (163.) Rostrum with complete central furrow, dilated towards apex; tubercles on interval 3 continuous to apex. 80. *H. deplorabundus* Fåhr.
165. (162.) Rostrum with two regular rows of shining granules; prothorax with six regular rows of long, cylindrical, spiniform tubercles ..... 88. *H. spinicollis* Gyl.
166. (161.) Interval 2 without any conical tubercles on the declivity; rostrum very coarsely reticulate throughout ..... 81. *H. crispatus* F.
167. (140.) Scrobes lateral.
168. (177.) Inferior basal furrow on rostrum absent.
169. (176.) Prothorax irregularly set with low rounded tubercles, the central furrow containing a carina.
170. (175.) Body without long erect black setæ.
171. (172.) Anteocular furrows distinct ..... 82. *H. infacetus* Gyl.
172. (171.) Anteocular furrows absent.
173. (174.) Rostrum without a central carina; the two basal joints of funicle subequal ..... 83. *H. frontalis* Sparrm.
174. (173.) Rostrum with a strong central furrow; second joint of funicle longer than first ..... 84. *H. tuberosus* Gyl.
175. (170.) Entire body with scattered, long, erect black setæ. 85. *H. pilosus*, sp. nov.
176. (169.) Prothorax with six rows of long cylindrical spiniform tubercles, the central furrow without a carina. 86. *H. thoracicus* Fåhr.
177. (168.) Inferior basal furrow on rostrum present.
178. (191.) Either interval 2 or 3, or both, with a single tubercle at the summit of the declivity conspicuously larger than the rest.
179. (182.) Prothorax with no median carina.
180. (181.) Rostrum without a central carina ..... 89. *H. seriespinosus* Gyl.
181. (180.) Rostrum with a fine central carina..... 90. *H. carinirostris* Gyl.
182. (179.) Prothorax with a median carina.
183. (184.) Rostrum with a fine central carina..... 91. *H. affinis* Fåhr.
184. (183.) Rostrum without a central carina.
185. (188.) Elytra with rows of ocellated punctures.
186. (187.) Prothorax scarcely transverse, its sides not much rounded ..... 93. *H. fallax* Fåhr.
187. (186.) Prothorax very transverse, its sides strongly rounded. 92. *H. binodis* Gyl.
188. (185.) Elytra with rows of reticulated foveæ.
189. (190.) Costa on interval 3 terminating abruptly at the declivity; interval 7 simply carinate and without tubercles ..... 94. *H. quadrinodis* Fåhr.

190. (189.) Costa on interval 3 continued to apex in the form of separated tubercles; interval 7 not carinate, but with a row of 7 to 10 conical tubercles. 95. *H. braunsi* Mshl.
191. (178.) Elytra without solitary tubercles at the summit of the declivity conspicuously larger than the rest. 96. *H. errans* Mshl.
192. (139.) All intervals on the elytra evenly raised.
193. (202.) Scrobes directed beneath base of rostrum.
194. (201.) Inferior basal furrow on rostrum present.
195. (196.) Prothorax with six rows of long cylindrical spiniform tubercles ..... 87. *H. aculeatus* Mshl.
196. (195.) Prothorax with small, closely-set, granular tubercles.
197. (200.) Prothorax with a distinct central carina.
198. (199.) Prothorax almost as long as broad; ocular lobes well developed ..... 97. *H. squalidus* Gyl.
199. (198.) Prothorax distinctly transverse; ocular lobes feeble. 98. *H. modestus*, sp. nov.
200. (197.) Prothorax without a central carina ..... 101. *H. permixtus*, sp. nov.
201. (194.) Inferior basal furrow on rostrum absent. 99. *H. granatus* Gyl.
202. (193.) Scrobes lateral.
203. (206.) Inferior basal furrow on rostrum present.
204. (205.) Rostrum short and thick; antennæ and tarsi short, the second joint of latter much shorter than third. 102. *H. albicans* Gyl.
205. (204.) Rostrum long and comparatively slender; antennæ and tarsi elongate, the second joint of latter equal to third ..... 104. *H. cinereus*, sp. nov.
206. (203.) Inferior basal furrow on rostrum absent.
207. (208.) Rostrum with a central furrow but no carina. 100. *H. partitus* Gyl.
208. (207.) Rostrum with a distinct central carina.
209. (212.) Second joint of funicle much longer than first.
210. (211.) Elytra narrow and elongate, the intervals with rows of distant rounded tubercles bearing long erect black setæ ..... 103. *H. capicola* Gyl.
211. (210.) Elytra ovate, the intervals with rows of irregular, and often duplicated, granules bearing short suberect dark setæ ..... 105. *H. setiferus* Gyl.
212. (209.) The two basal joints of funicle subequal.
213. (214.) Body with long erect black setæ ..... 106. *H. pilifer* Fåhr.
214. (213.) Body with short depressed setæ.
215. (216.) Forehead without a central carina; size small, 10 to 12 mm. ..... 107. *H. laticeps* Mshl.
216. (215.) Forehead with a central carina; size larger, 19 to 22 mm.
217. (218.) Length of prothorax about equal to its breadth; dorsal part of rostrum very little elevated. 108. *H. gunningi* Mshl.
218. (217.) Prothorax much broader than long; dorsal part of rostrum strongly elevated above the level of the forehead ..... 109. *H. constrictus* Gyl.
219. (66.) Rostrum with a basal tubercle or horn.
220. (221.) Rostrum with a deep transverse incision behind middle but in front of the basal horn ..... 110. *H. incisirostris* Mshl.
221. (220.) Rostrum with no transverse incision in front of the basal horn.
222. (223.) Each elytron with a large tubercular prominence just above the apex ..... 111. *H. dregei* Gyl.
223. (222.) Elytra with no prominence near apex.
224. (225.) Rostrum with no central carina, but with a deep central furrow and two large tubercles at base separated by the furrow; prosternum with a tubercle in front of each anterior coxa ..... 112. *H. brachyceroides* Mshl.
225. (224.) Rostrum with no central furrow but having a carina and with a single basal tubercle usually bifid at apex; prosternum without tubercles.
226. (231.) Elytra with intervals 2, 4, and 6 more or less devoid of granules.

227. (230.) Anteocular furrows distinct; prothorax with only the central line smooth.
228. (229.) Central carina on rostrum only reaching middle; granules on elytra large, distant, and elongate. 113. *H. armatus* Fåhr.
229. (228.) Central carina on rostrum reaching apex; granules on elytra smaller and more closely set.. 114. *H. monitor* Fåhr.
230. (227.) Anteocular furrows absent; prothorax with three smooth dorsal lines ..... 115. *H. nasutus* Fåhr.
231. (226.) Elytra with all intervals equally and evenly granulate.
232. (233.) Prothorax with long, cylindrical, truncate tubercles. 116. *H. coronatus* Fst.
233. (232.) Prothorax with small, low, rounded tubercles.
234. (235.) Central carina on rostrum obsolescent; rostral tubercle bifid and distinctly dilated at apex.... 117. *H. consors* Mshl.
235. (234.) Central carina on rostrum distinct; rostral tubercle bifid, but not dilated at apex.
236. (237.) Prothorax as long as broad; striæ on elytra deep and strongly punctured; rostrum shorter and thicker, its dorsal outline strongly angulated about middle. 118. *H. corniculatus* Fåhr.
237. (236.) Prothorax broader than long; striæ on elytra very shallow, finely punctured; rostrum longer and more slender, its dorsal outline not angulated but gently curved ..... 119. *H. propinquus*, sp. nov.
238. (65.) Scape of antennæ reaching beyond anterior margin of eye.
239. (250.) Rostrum with a basal horn or tubercle.
240. (243.) Rostral tubercle rudimentary.
241. (242.) Granules on elytra large and distinct; first joint of posterior tarsi very long in ♂, longer than second and third together ..... 120. *H. bimaculatus* Mshl.
242. (241.) Granules on elytra very minute on the lateral intervals, obsolete on those near sutures; posterior tarsi normal in ♂ ..... 121. *H. cervinus*, sp. nov.
243. (240.) Rostral tubercle strongly developed.
244. (249.) All intervals on elytra evenly granulate.
245. (248.) Forehead not plicate; striæ on elytra finely punctured; granules on intervals small and inconspicuous.
246. (247.) Intervals on elytra all even; forehead with a short stria ..... 122. *H. talpa* Fåhr.
247. (246.) Intervals 3, 5, and 7 slightly more raised than the others; forehead without any stria ... 123. *H. vicinus* Mshl.
248. (245.) Forehead with fine convergent plications; striæ on elytra rugosely punctured, subreticulate; granules on intervals large and shining but depressed. 124. *H. brevis* Mshl.
249. (244.) Elytra with at most a few solitary granules on intervals 4 and 6 ..... 125. *H. incertus* Mshl.
250. (239.) Rostrum without a basal tubercle.
251. (258.) Intervals on elytra with distinct granules or small tubercles throughout.
252. (253.) Inferior basal furrow of rostrum very deep; elytra of normal shape; legs short and thick. 126. *H. arenarius* Fåhr.
253. (252.) Inferior basal furrow of rostrum absent; elytra very narrow, legs long and slender.
254. (255.) Forehead impressed; prothorax broadest behind middle ..... 127. *H. seriegranosus* Gyl.
255. (254.) Forehead convex; prothorax broadest at or before middle.
256. (257.) Rostrum thick, the outer lateral carinæ undulating; granules on elytra with long black setæ. 128. *H. longulus* Gyl.
257. (256.) Rostrum slender, elongate, the lateral carinæ straight; granules with very short pale setæ. 129. *H. sjöstedti*, sp. nov.
258. (251.) Dorsal intervals on elytra quite smooth, or at most with very faint ill-defined granules.

259. (266.)	Scape not exceeding posterior margin of eye.
260. (263.)	Setæ on elytra erect or suberect.
261. (262.)	Dorsal intervals on elytra faintly granulate, the setæ erect and black ..... 131. *H. porculus* Sparrm.
262. (261.)	Dorsal intervals on elytra quite smooth, the setæ pale and suberect... ..... 130. *H. granicollis* Gyl.
263. (260.)	Setæ on elytra strongly depressed.
264. (265.)	Prothorax with sides moderately rounded and not constricted at apex; elytra shallowly but distinctly sulcate, especially towards the sides. 132. *H. varius* Fåhr.
265. (264.)	Prothorax constricted at apex and with the sides strongly rounded; elytra scarcely sulcate. 133. *H. o'neili*, sp. nov.
266. (259.)	Scape exceeding posterior margin of eye.
267. (270.)	The first joint of funicle longer than the second (more markedly so in the ♂).
268. (269.)	Forehead with a faint carina; granules on prothorax larger and more distant ..... 134. *H. lineatus* Fåhr.
269. (268.)	Forehead with no carina; granules on prothorax small and closely set ..... 135. *H. vittatus* Fåhr.
270. (267.)	The two basal joints of funicle subequal in both sexes.
271. (272.)	The upper lateral sulci on rostrum very deep, almost hidden towards apex under the carinæ which adjoin them internally ..... 136. *H. sublineatus* Gyl.
272. (271.)	Upper lateral sulci on rostrum shallow, not overhung by the adjoining carinæ.
273. (274.)	Tubercles on prothorax elevated and sparsely set; elytra broadest at or before middle, the shoulders roundedly prominent ..... 137. *H. subvittatus* Gyl.
274. (273.)	Tubercles on prothorax low, rounded and closely set; elytra broadest far behind middle, the shoulders sloping ..... 138. *H. dolorosus* Fåhr.

Those species marked † are not at present represented in the British Museum.

1. H. APPENDICULATUS Gyl.

H. appendiculatus Gyl. Schönh. Gen. Curc. v. p. 788 (1840).

Long. 16–20, lat. 6½–9 mm.

Head very convex and with sparse faint punctuation, forehead retuse and with a shallow impression; anteocular furrows present but not very deep. *Rostrum* separated from head by a transverse basal incision, as long as prothorax only, thick, curved and gradually dilated towards apex. Upper surface with five carinæ, of which the central three coalesce at base to form a stout prominent tubercle, the central carina (which is abbreviated anteriorly) and the outer pair are smooth, the remaining pair being strongly punctured; lateral sulci deep, subequal, the upper pair uniting at base; scrobes deep, lateral and parallel to sulci; inferior basal furrow very deep. *Antennæ* with dense brown setæ; scape just reaching eye; the two basal joints of funicle subequal. *Prothorax* as long as broad in ♂, broader than long in ♀, apex narrower than base, sides strongly rounded, broadest about middle, dorsal anterior margin slightly convex, ocular lobes well developed. Upper surface slightly convex, moderately closely set with low rounded tubercles, leaving a narrow central furrow without any carina; tubercles each with a depressed short seta, the interstices with dense light brown scaling. *Elytra* narrow, oblongo-ovate in ♂, more broadly ovate in ♀, shoulders sloping,

apical processes rudimentary in ♂—long, stout and sharp in ♀, being porrect and subparallel. Upper surface convex, with broad sulci containing rows of minute separated granules; the intervals narrowly carinate, each with a regular row of large closely placed granules, which become subconical near apex, except on intervals 2 and 4, where they vanish altogether on the declivity; the granules bare, each with a short suberect dark seta, the interspaces with dense brown scaling. *Legs* with sparse pale setæ; the posterior tarsi with the 3rd joint a trifle broader than the others, 2nd and 3rd subequal, 1st rather longer.

CAPE COLONY: Uitenhage (*Rev. J. A. O'Neil*), Willowmore (*Dr. H. Brauns*).

TYPE in the Stockholm Museum.

The only near ally of this species is *cornirostris* Gyl., from which it differs in the less closely tuberculate prothorax, the greater elevation of the intervals on the elytra, the abrupt cessation of the granules on intervals 2 and 4 at the top of the declivity, and the much longer and stouter apical processes in the ♀. Father O'Neil informs me that both species are scarce at Uitenhage, especially *cornirostris*; they are both found in loose soil under the curious plant locally known as the Tortoise Bush.

2. H. CORNIROSTRIS Gyl.

H. cornirostris Gyl. Schönh. Gen. Curc. v. p. 787 (1840).

Long. 15–21, lat. 6–9 mm.

Head convex, with sparse and shallow punctuation; forehead somewhat impressed, without any fovea or carina; anteocular furrows distinct. *Rostrum* separated from head by a transverse basal incision, as long as prothorax only, slightly curved, dilated towards apex. Upper surface with five distinct carinæ, the three central ones converging at base to form a stout tubercle, the median carina is smooth and narrower than the others, which are more or less strongly punctured; lateral sulci deep and of equal length, the upper pair uniting at base; scrobes deep, entirely lateral and parallel to the sulci; inferior basal furrow very deep. *Antennæ* with the scape just reaching eye; the two basal joints of funicle subequal. *Prothorax* as long as broad in ♂, broader than long in ♀, apex narrower than base, sides strongly rounded, broadest about middle, dorsal anterior margin convex, ocular lobes well developed. Upper surface rather convex, very closely set with small low rounded tubercles, leaving a very narrow central furrow containing no carina; tubercles each with a very short dark depressed seta, interstices with dense brown scaling. *Elytra* oblongo-ovate, elongate in ♂, more ampliated in ♀, shoulders sloping, apical processes (in ♀ only) sharply conical. Upper surface convex, with shallow sulci containing rows of distinct granules; the intervals all similar, each with a regular row of small granules, more closely set than those in the sulci; granules each with a depressed dark seta, the interstices with fulvous scaling which is usually abraded. *Legs* rather long, with

very sparse pale scaling and setæ, forming a pale ring near apex of femora; posterior tarsi broad, spongy, 3rd joint a little broader than the other two, 2nd and 3rd subequal, 1st rather longer.

Cape Colony: Uitenhage (*Rev. J. A. O'Neil*), Fraserburg (*E. G. Alston*).

Type in the Stockholm Museum.

3. H. verrucosus L.

Curculio verrucosus L. Mus. Lud. Ulr. p. 60 (1764); Ol. Ent. v. 83, p. 387, t. 10. f. 125, ♀ (1807); Herbst, Col. vi. p. 308, t. 84. f. 5, ♂ (1795).

H. verrucosus Gyl. Schönh. Gen. Curc. i. p. 481 (1833).

Long. 21–25, lat. 8½–10 mm.

Head convex, shagreened and with sparse scaling on vertex, forehead distinctly but dispersely punctured and with a central fovea or short stria; anteocular furrows indistinct. *Rostrum* shorter than prothorax, cut off from head by a deep basal incision, thick, strongly curved and gradually dilated to apex. Upper surface with a deep central furrow, narrow at base and dilating anteriorly, deeply and sometimes rugosely punctured; lateral sulci deep, the upper pair uniting at base and much longer than the lower; scrobes broad and deep, entirely lateral; inferior basal furrow very deep. *Antennæ* with scape reaching eyes; the two basal joints of funicle subequal. *Prothorax* rather broader than long, apex narrower than base, sides rounded, broadest about middle, dorsal anterior margin slightly convex, ocular lobes well developed. Upper surface convex, closely but irregularly set with large flattened tubercles, leaving a distinct central furrow containing a very faint carina; tubercles black, bare, each with a large puncture but no seta, the interstices normally greenish bronze with sparse pale depressed setæ. *Elytra* elongato-ovate, acuminate apically, shoulders prominent, sides ampliated, broadest before middle, apical processes strongly tuberculate, short and rounded in ♂, elongate, thick and subconical in ♀. Upper surface convex, with rows of remote shallow punctures separated by small granules; intervals 3, 5, and 7 with complete rows of depressed, elongate and catenulate tubercles which become conical and separated close to apex; intervals 1 and 6 with similar but much less complete rows; 2 and 4 quite smooth; apices of tubercles bare, black, only a few of them with short setæ; the interstices devoid of scaling, black with a strong bronze or greenish-bronze lustre. *Legs* with sparse setæ, the posterior tibiæ very strongly curved in ♂ only; posterior tarsi with the joints of the same width, 2nd and 3rd subequal, 1st rather longer.

Cape Colony: Cape Town, Stellenbosch (*L. Péringuey*).

Of this striking and aberrant species Mr. Péringuey notes that it is not uncommon about the Cape and may be met crawling slowly along the ground. He has found it on heath plants and also on the branches of the Sugar Bush (*Protea grandiflora*) and Silver Tree (*Leucadendron argenteum*).

4. H. OAXUS Mshl. (Plate I. fig. 1.)

H. oaxus Mshl. Ann. Nat. Hist. (7) x. p. 416 (1902).

Long. 23–34, lat. 8½–9 mm.

Head convex, bare, punctuation close but faint on vertex, deeper and more scattered in front, forehead rather retuse and with two faint rounded impressions; anteocular furrows distinct. *Rostrum* cut off from head by a deep dorsal incision, almost as long as head and prothorax, distinctly curved, subparallel from base to beyond middle, then gradually dilated to apex. Upper surface convex in the basal part, which is smooth, shiny, and with fine sparse punctuation, very shallowly excavate towards apex, where the punctures are much closer and deeper; lateral sulci strong and deep, the intervening carina narrow and undulating, the lower pair longer, the upper pair scarcely uniting at base; scrobes deep, lateral and parallel with sulci; inferior basal furrow very broad and deep. *Antennæ* with scape just reaching eye; 2nd joint of funicle longer than 1st in ♂, subequal in ♀. *Prothorax* rather broader than long, apex about as broad as base, which is equal to the length in ♀, but narrower in ♂, sides distinctly rounded, broadest about middle, dorsal anterior margin truncate, ocular lobes strongly developed. Upper surface slightly convex, fairly closely set with large elevated rounded tubercles bearing depressed setæ and leaving a narrow central furrow without a carina; scaling absent. *Elytra* oblongo-ovate, shoulders rounded and more prominent in ♀, sides slightly rounded, broadest before middle, apices slightly and bluntly projecting in ♂, with sharp parallel processes in ♀ 1 mm. long. Upper surface convex, the dorsal striæ simply punctate, the outer ones granulate; interval 1 quite smooth to near the declivity, but with distinct granules from there to apex; interval 2 quite smooth throughout; 3, 5, and 7 with tubercles strongly depressed to beyond middle, then sharply conical, those on 3 being specially prominent and continued right on to the apical processes in both sexes; intervals 4 and 6 with rows of depressed tubercles ceasing beyond middle; tubercles almost entirely devoid of setæ. *Elytra* bare and with a strong dull bronze reflexion. *Legs* without scaling; femora finely punctured at base, impunctate in middle and very coarsely punctured at apex; the posterior and anterior tibiæ strongly curved in ♂, especially the former; joints 2 and 3 of posterior tarsi subequal, the 1st a little longer.

CAPE COLONY.

TYPE in the British Museum.

Very nearly allied to *H. verrucosus* L., but in addition to the distinctions mentioned in the key, it differs in having the thoracic tubercles more elevated; the discal portions of intervals 1 and 3 near the base are quite plane and smooth, and not tuberculate or carinate; the discal punctures on the elytra are deep and simple, whereas in *verrucosus* they are shallow and with a small but distinct granule at the side of each.

5. H. RUGIROSTRIS Gyl.

H. rugirostris Gyl. Schh. Gen. Curc. v. p. 791 (1840).

Long. 17–20, lat. 7–8½ mm.

Head strongly convex, both on vertex and forehead, bare and with large scattered punctures; anteocular furrows distinct. *Rostrum* cut off from head by a deep transverse basal incision, as long as head and prothorax, thick, strongly curved and gradually dilated to apex. Upper surface convex, slightly excavate near apex only, deeply and rugosely punctured throughout; lateral sulci deep, of equal length, subparallel, the upper pair alone uniting at base; scrobes deep and lateral; inferior basal furrow very deep. *Antennæ* with scape just reaching eye; the two basal joints of funicle subequal. *Prothorax* somewhat transverse, apex scarcely narrower than base, sides rounded, broadest rather behind middle, dorsal anterior margin truncate, ocular lobes strongly developed. Upper surface convex, closely set with low rounded tubercles, leaving a very indistinct central furrow; tubercles without setæ, both they and the interstices bare of scaling. *Elytra* ovate, shoulders roundly prominent, sides slightly ampliated, broadest before middle, apices produced into a very short blunt callosity in ♂, more acuminate and subcontiguous in ♀. Upper surface with shallow sulci containing rows of large ocellated punctures, often separated by low granules; all the intervals with rows of small closely set depressed tubercles, those on intervals 2 and 4 ceasing at the declivity, those on 1 and 3 continued to apex, being conical and subcristate on the declivity; scaling absent, tubercles rarely with depressed dark setæ. *Legs* with scattered pale setæ; posterior tibiæ very strongly curved in ♂ only; posterior tarsi with the three basal joints subequal in length and breadth.

NAMAQUALAND: Klipfontein and O'okiep (*L. Péringuey*).

TYPE in the Stockholm Museum.

This is a scarce species in collections, but Mr. Péringuey states that he found it commonly in Little Namaqualand at from 3000 to 4000 ft. under a spiny species of *Mesembryanthemum*.

A close ally of *verrucosus* L. and *oaxus* Mshl., resembling the latter in the absence of the rostral furrow. Apart from its smaller size and more regularly granulate elytra this species differs from *oaxus*: (1) in the coarse punctuation of the base of the rostrum, (2) in having the lateral sulci on the rostrum of equal length, and (3) in having the two basal joints in the funicle of the ♂ equal, or even with the first very slightly longer than the second.

6. H. SERIENODOSUS Gyl.

H. serienodosus Gyl. Schh. Gen. Curc. i. p. 490 (1833); Fähr. Schh. op. c. v. p. 779 (1840).

Long. 12–14, lat. 5–6 mm.

Head convex, with obscure punctuation and sparse scaling,

forehead with two shallow impressions; anteocular furrows present but not very distinct; eyes rather prominent. *Rostrum* a little longer and narrower in ♂, with a deep transverse incision at base, as long as prothorax only, slightly curved, its sides subparallel but with the genæ slightly dilated at the apex. Upper surface coarsely punctured, with five narrow undulating carinæ of equal height; lateral sulci deep, of equal length, the upper pair meeting at base; scrobes straight, lateral, parallel to sulci; inferior basal furrow very deep. *Antennæ* with scape scarcely reaching eye; the two basal joints of funicle subequal. *Prothorax* transverse, apex narrower than base, sides strongly rounded, broadest rather behind middle, dorsal anterior margin truncate, ocular lobes slight. Upper surface slightly convex, with a faint transverse impression near apex, closely set with small rounded tubercles leaving a narrow central furrow without any carina; tubercles bare, with depressed dark setæ, interstices with dense brown scaling. *Elytra* ovate, much narrower in ♂, shoulders sloping, sides rounded, broadest about middle, apical processes short, blunt, and parallel in ♀, absent in ♂. Upper surface convex, with rows of ill-defined shallow punctures often separated by granules; interval 1 with a complete row of small closely-set granules; intervals 2, 4, and 6 devoid of tubercles; 3, 5, and 7 with complete rows of small subconical tubercles which hardly increase in size posteriorly, but are rather larger and more distant in the ♀, especially on interval 3; tubercles bare, with short depressed dark setæ, interstices with dense brown scaling. *Legs* with sparse pale scaling, forming a denser ring near apex of femora; posterior tarsi with 3rd joint a little broader than the others, 2nd and 3rd subequal, 1st a little longer.

Cape Colony: Enou (*Hulter*).

Type in the Stockholm Museum.

7. H. seriatus Gyl.

H. seriatus Gyl. Schönh. Gen. Curc. v. p. 777 (1840).

Head convex on vertex, rugosely punctured, with grey scaling and erect dark setæ; forehead subimpressed, with a median carina. *Rostrum* separated from head by a shallow dorsal incision, as long as prothorax, strongly curved, dilated beyond middle. Upper surface with five carinæ, the median one broader than the others and impunctate; lateral sulci deep, the upper pair rather longer and meeting at base; scrobes directed beneath base of rostrum; inferior basal furrow absent. *Antennæ* with scape reaching eye; the two basal joints of funicle short, subequal. *Prothorax* broader than long, the length equal to width at base, apex a little narrower, sides moderately rounded, broadest at middle, ocular lobes well developed. Upper surface somewhat convex, unevenly set with small rounded tubercles, leaving a central furrow containing an abbreviated carina; tubercles bare, with long erect dark setæ, the interstices with greyish scaling. *Elytra* oblongo-ovate, shoulders roundedly prominent, sides sub-

parallel to beyond middle, apical processes very small. Upper surface moderately convex, rugulose, with rows of deep foveæ; intervals 3, 5, and 7 raised, costate and undulating near base, tuberculate towards apex; colour black, with scattered long erect dark setæ. *Legs* thick, pilose and coarsely punctured; posterior tarsi broad, the joints of about the same width, 2nd and 3rd subequal, 1st rather longer.

"Cape of Good Hope (*Drège*)"—*teste* Schönherr.

Type in the Stockholm Museum.

I have seen only a single example from Drège's collection at Stockholm. The species holds a somewhat intermediate position between the two main divisions of the genus owing to the comparatively shallow incision which separates the head from the rostrum. This is further emphasised by the absence of the inferior basal furrow on the rostrum, which is always present and usually very strongly developed in the species falling within Schönherr's "Grex 2."

8. H. caffer Thunb.

Curculio caffer Thunb. Nov. Act. Ups. vii. p. 120 (1815).
Curculio calvus Herbst, Col. vii. p. 46, t. 98. f. 4 (1797).
H. calvus Gyl. Schönh. Gen. Curc. i. p. 486 (1833).
H. caffer Gyl. l. c. p. 487 (1833).
H. rhamphastus Gyl. l. c. p. 486 (1833); Labr. & Imh. Gen. Curc. ii. no. 35 (1848).

Long. 14–15, lat. 5½–6 mm.

Head convex, punctate and with scattered setiform scaling, forehead retuse and with a shallow central impression; eyes with a deep curved impression along their upper edges; anteocular furrows deep. *Rostrum* as long as prothorax, cut off from head by a deep incision, thick, strongly curved, dilated at apex. Upper surface coarsely punctured, with five strong smooth carinæ of about even height; lateral sulci broad and deep, the upper pair much longer than the lower and uniting at base; scrobes deep, lateral; inferior basal furrow very deep. *Antennæ* with scape scarcely reaching eye; the two basal joints of funicle subequal. *Prothorax* a little broader than long, apex and base of equal width, sides rounded, broadest at middle, anterior margin truncate, ocular lobes small. Upper surface convex, closely set with small rounded tubercles, leaving a well-marked central furrow containing no carina; tubercles bare, shining, each with a short depressed seta, the interstices with brownish scaling and three distinct white longitudinal lines. *Elytra* elongato-ovate, narrower in ♂, shoulders roundedly prominent, sides slightly ampliated, broadest about middle, apical processes absent. Upper surface convex, with regular rows of large, ocellated and subreticulate punctures; intervals 1, 3, 5, and 7 much more strongly raised than the others and showing faint traces of depressed subcatenulate granules bearing very short depressed setæ; intervals 2, 4, and 6 smooth, narrow and slightly costate, interval 2 with a

large tubercle at base; at the apex of interval 3 there is occasionally seen a distinct tubercular projection (var. *rhamphastus* Gyl.), but this is very variable in development and is more often absent; the elytra are sparsely covered with small greyish scales, which are larger and whiter on the inflexed margins. *Legs* thinly clothed with whitish setæ; posterior tarsi with the 3rd joint slightly broader than the others, 2nd and 3rd subequal, 1st a little longer.

CAPE COLONY: Cape Town.

H. rhamphastus of Gyllenhal can only be regarded as a variety of this species, the development of the intra-apical callus being very variable, and quite unreliable as a specific character.

Mr. Péringuey states that although this species is fairly common on the flats about Cape Town, he has never found it on the mountains.

9. H. QUADRILINEATUS Gyl.

H. quadrilineatus Gyl. Schönh. Gen. Curc. v. p. 780 (1840).

Long. 10–11, lat. 4½–5 mm.

Head convex, dispersely punctured and scaled; forehead not retuse, but with a shallow central impression, an impressed curved line above eye; anteocular furrows deep. *Rostrum* rather longer than prothorax, separated from head by a deep incision, thick, distinctly curved and dilated at apex. Upper surface coarsely punctured, with five strong smooth carinæ of about even height; lateral sulci deep, the upper pair much longer than the lower and meeting at base; scrobes deep, lateral; inferior basal furrow very deep. *Antennæ* with scape scarcely reaching eye; the two basal joints of funicle subequal. *Prothorax* slightly transverse, apex and base of equal width, sides rounded, broadest at middle, dorsal anterior margin truncate, ocular lobes moderate. Upper surface convex, fairly closely set with small rounded tubercles, leaving a distinct central furrow containing no carina; tubercles bare, shiny and with short depressed setæ, the interstices with 3 distinct longitudinal lines of white scales. *Elytra* ovate, shoulders roundedly prominent, sides rounded, broadest about middle, apical processes absent. Upper surface convex, with regular rows of large subreticulate punctures; the intervals 1, 3, 5, and 7 much more raised than the others, strongly costate and with distinct traces of depressed setigerous granules; intervals 2, 4 and 6 quite plane and smooth, and densely clothed with small greyish or yellowish scaling, whereas the elevated intervals are quite bare. *Legs* sparsely covered with whitish setæ; posterior tarsi with the joints of about the same width, 2nd and 3rd subequal, 1st rather longer.

CAPE COLONY; Albany, Alicedale [S. A. Mus.].

Gyllenhal's specimen, which is one of the many missing types from Drège's collection, was evidently abraded, as is not unusual in this species. The insect is a very near ally of *caffer* Thunb., from which it differs in its much smaller size; its shape, being

much broader in proportion to its length; in that the intervals 2, 4, and 6 on the elytra are broader and quite plane and that the interval 2 has no sign of a tubercular prominence at its base; finally, in perfect specimens, the colouring is strikingly distinct.

10. H. SETULOSUS Gyl.

H. setulosus Gyl. Schh. Gen. Curc. v. p. 777 (1840).

Long. 20, lat. 8 mm.

Head convex, with the punctuation close and fine on vertex, fainter and more diffuse in front, forehead without a carina or fovea; eyes surrounded by a deep impressed ring; anteocular furrows distinct. *Rostrum* separated from head by a deep dorsal incision, very thick and distinctly curved, as long as head and prothorax. Upper surface without any central furrow, rugosely punctured and with 5 narrow carinæ, the central one narrower and less distinct than the others; scaling absent, replaced by short, erect, paler setæ; lateral sulci deep and of about equal length, the upper pair meeting at base; scrobes lateral and parallel to the sulci; inferior basal furrow very deep. *Antennæ* with the scape just reaching eye; the two basal joints of funicle subequal. *Prothorax* transverse, apex and base of about equal width, sides strongly rounded, broadest about middle, dorsal anterior margin truncate, anteocular lobes strongly developed. Upper surface rather convex, closely set with small rounded tubercles leaving a central furrow containing no carina; tubercles with short depressed setæ, interstices with sparse suberect pale setæ. *Elytra* ovate, shoulders rounded, sides slightly rounded, broadest before middle, apices bluntly prominent. Upper surface rather convex, with regular rows of large shallow punctures separated by distinct granules, the intervals costate, the alternate ones more strongly so; intervals 3, 5, and 7 with regular and complete rows of small, closely set, subconical tubercles, those on the declivity of 3 being a good deal larger than the others; intervals 1 and 2 are quite plane; interval 4 has a short row of granules, largest near base and disappearing behind middle; interval 6 has a complete row of small granules; apices of tubercles with short erect pale setæ, their sides and the rest of the elytra thinly clothed with yellow recumbent setæ instead of scales. *Legs* with only scattered pale setæ; posterior tarsi with the three basal joints subequal in length and breadth.

CAPE COLONY.

This species can be easily distinguished from all its near allies by the setose, instead of squamose, elytra.

11. †H. GRAVIDUS, sp. nov.

Long. 17–19, lat. 8–9½ mm.

Head convex, very rugose and with sparse white scaling; anteocular furrows rather indistinct. *Rostrum* separated from head by a distinct dorsal incision, as long as prothorax only, moderately curved, its sides subparallel throughout, but with the genæ dilated.

Upper surface with a deep and continuous central furrow, and a broad coarsely-punctured carina on each side of it; lateral sulci deep, not meeting at base, subequal in length and breadth, the intervening carina narrow and impunctate; scrobes lateral, deep, straight and parallel to the sulci; inferior basal furrow present, but comparatively shallow. *Antennæ* with sparse white setæ; scape just reaching eye; the first joint of funicle longer than second in ♀, about equal to it in ♂. *Prothorax* a little broader than long, apex much narrower than base, sides not much rounded, broadest about middle, dorsal anterior margin slightly convex, ocular lobes strongly developed. Upper surface convex, closely set with low rounded tubercles, leaving a very narrow (sometimes scarcely distinguishable) central furrow containing no carina; tubercles bare, shiny, each with a short subdepressed dark seta, the interstices fairly closely covered with large round white scales. *Elytra* broad, oblongo-ovate, shoulders sloping, sides but little rounded, broadest about middle, apical processes very short and tuberculiform in both sexes. Upper surface convex, with very shallow sulci containing rows of distinct granules; intervals 1, 2, 4, and 6 each with a regular and complete row of granules scarcely bigger than those in the sulci; 3, 5, and 7 each with a complete row of large conical tubercles, which become smaller and less conical towards the base on the disk; tubercles bare, each with a short subdepressed dark seta, the interspaces with scattered large round white scales. *Legs* thick, with large scattered punctures and sparse white scaling; all the tibiæ strongly serrate internally; posterior tarsi short, the three joints subequal in length and breadth.

NAMAQUALAND: O'okiep (*L. Péringuey*).

TYPE in the South African Museum.

Nearly allied to *H. verrucellus* Gyl. and *H. obesus* Gyl., but readily distinguished by the three rows of large conical tubercles on each elytron.

12. H. VERRUCELLUS Gyl.

H. verrucellus Gyl. Schh. Gen. Curc. v. p. 784 (1840).

Long. 16, lat. 7½ mm.

Head convex, with scattered large coarse punctures and sparse white scaling, forehead rugosely wrinkled; eyes rather prominent; anteocular furrows faint. *Rostrum* with a deep dorsal incision at base, shorter than prothorax, slightly curved and the sides subparallel throughout, the genæ being very little dilated. Upper surface very rugosely punctured and with a deep and continuous central furrow containing no carina; lateral sulci deep, filled with white scaling, and separated by a narrow wavy carina, the upper part slightly shorter and almost uniting at base; scrobes lateral, almost parallel to the sulci; inferior basal furrow deep. *Antennæ* with scape just reaching eye; the two basal joints of funicle subequal. *Prothorax* about as long as broad, apex much narrower than base, sides very slightly dilated to

beyond middle, thence rapidly narrowed to apex, dorsal anterior margin convex, ocular lobes well developed. Upper surface convex, closely covered with low rounded tubercles, leaving a narrow central furrow without any carina; tubercles bare, with very short depressed dark setæ, interstices with scattered round white scales, forming denser central and lateral stripes. *Elytra* ovate, shoulders slightly prominent, sides somewhat rounded, broadest about middle, apical processes very short but sharp. Upper surface convex, with deep sulci containing rows of large distant granules; intervals each with a single row of small, low, rounded and closely-set tubercles, except on the declivity of intervals 2 and 4, where they are more elevated and subcylindrical; tubercles and granules bare, shiny, each with a short depressed dark seta; scales large, round, and white, forming small irregular spots and patches, especially towards the sides and apex. *Legs* thick, coarsely punctured, with scattered white scaling and long black setæ; tibiæ strongly curved in male, and the femora and tibiæ with strong tooth-like granules along their inner edges in both sexes; posterior tarsi broad, the joints subequal in length and breadth.

Cape Colony.

Type in the Stockholm Museum.

13. H. obesus Gyl.

H. obesus Gyl. Schh. Gen. Curc. v. p. 782 (1840).

Long. 19, lat. 9 mm.

Head convex on vertex, coarsely punctured, forehead with two large and deep impressions separated by a sharp carina; eyes surrounded by a distinct impressed ring; anteocular furrows almost obsolete. *Rostrum* about as long as head and prothorax, separated from head by a deep dorsal incision, slightly curved, genæ scarcely dilated, so that the sides are subparallel throughout. Upper surface with a central furrow which is narrow at base and broader and shallower anteriorly, the adjoining costæ indistinctly granulate; lateral sulci subequal, broad and deep, filled with large white scales and separated by a sharp carina, the upper pair meeting at base; scrobes directed beneath base of rostrum; inferior basal furrow broad and deep. *Antennæ* with scape scarcely reaching eye; the two basal joints of funicle subequal. *Prothorax* distinctly transverse, apex narrower than base, sides strongly rounded, broadest about middle, dorsal anterior margin subtruncate, ocular lobes very prominent. Upper surface convex, moderately closely set with small rounded tubercles, leaving a narrow and very indistinct central furrow without any carina; tubercles bare, each with a minute depressed seta; interstices densely clothed with large round white scales. *Elytra* broadly oblongo-ovate, shoulders very prominent and subrectangular, sides subparallel to well beyond middle, apical processes absent. Upper surface very convex, with regular shallow sulci containing rows of large granules; all the intervals with single regular rows of low rounded tubercles, which are more conical, but not larger, on the

declivity; interval 3, however, has a short additional row about the summit of the declivity; tubercles bare, each with a minute depressed seta; interstices with large round white scaling, which is very sparse on disk but dense towards the sides. *Legs* with sparse white scaling and long black setæ; the joints of posterior tarsi broad, spongy beneath, and subequal in length and breadth.

Cape Colony.

Allied to *H. verrucellus* Gyl., but this is a larger and more robust insect; the central furrow on the rostrum is less deep, the prothorax is shorter and its sides much more strongly rounded, and the elytra lack the elevated tubercles on the declivity which are present in *verrucellus*.

14. H. congestus Mshl. (Plate I. fig. 2.)

H. congestus Mshl. l. c. p. 440 (1902).

Long. 13–17, lat. 6–8 mm.

Head convex, with rugose punctures, some of which contain a large white scale; forehead not flattened, coarsely striate; anteocular furrows deep and complete. *Rostrum* as long as the prothorax only, separated from head by a deep dorsal incision, distinctly curved, subparallel to beyond middle and then very slightly dilated. Upper surface convex, with a deep narrow central furrow throughout having a broad and coarsely-punctured costa on either side; lateral sulci not meeting at base, both pairs deep and distinct, of equal length and filled with white squamæ; scrobes deep and lateral, almost parallel to the sulci; inferior basal burrow broad and deep. *Antennæ* with scape just reaching eyes; the two basal joints of funicle subequal. *Prothorax* nearly as long as broad, the length equal to the width at base, apex much narrower, sides very little rounded, slightly diverging from base to near apex, then rapidly narrowing. Upper surface convex, closely set with large rounded shiny tubercles, leaving a very narrow, and sometimes obsolete, central furrow containing no carina; granules bare, with depressed dark setæ, the interstices with a few scattered white scales; dorsal anterior margin convex, ocular lobes strongly developed. *Elytra* broadly oblongo-ovate in ♀, much narrower in ♂, shoulders prominent and subrectangular, sides rounded, broadest about middle, apical processes very short but sharp in both sexes. Upper surface convex, with no distinct striation, the whole surface being equally covered with even and regular rows of rounded granules, except for a tubercular prominence on the declivity of the third interval (as in *albicinctus* Gyl.), and a much lower elongate one on the declivity of interval 5; these prominences are sometimes a good deal reduced in the ♂; granules bare and with very short depressed dark setæ, the interstices with a few isolated white scales which are more numerous near the margins, and a small but distinct white spot at the apex of the suture. *Legs* with scattered white scales and black setæ; the inner edges of tibiæ strongly dentate; posterior tarsi with the three basal joints subequal in length and breadth.

NAMAQUALAND: O'okiep (*L. Péringuey*).

TYPE in British Museum.

My original description was made from a single ♀ taken by Sir A. Smith; Mr. Péringuey has since shown me at Capetown a series of both sexes, which has enabled me to redescribe the species more accurately.

15. H. NAMAQUUS, sp. nov.

Long. 18, lat. 8 mm.

Head convex, bare, deeply and coarsely punctured, forehead with two deep longitudinal impressions; anteocular furrows present, but not very distinct. *Rostrum* separated from head by a transverse dorsal incision, as long as head and prothorax, slightly curved, sides subparallel throughout, but with the genæ dilated. Upper surface rugosely punctured, with a shallow central furrow, containing no carina, and two narrow undulating carinæ on each side of it; lateral sulci deep, of equal length, the upper pair uniting at base; scrobes deep, lateral and subparallel with the sulci; inferior basal furrow broad and deep. *Antennæ* with scape just reaching eye; the two basal joints of funicle subequal. *Prothorax* transverse, apex narrower than base, sides distinctly rounded, broadest about middle, dorsal anterior margin truncate, ocular lobes moderately developed. Upper surface convex, closely set with small rounded tubercles, leaving a very narrow and indistinct central furrow containing no carina; tubercles bare, each with a very short dark seta, the interstices with sparse large round white scales. *Elytra* ovate, shoulders angularly prominent, sides rounded, broadest rather behind middle, apical processes obsolescent in ♂. Upper surface convex, without distinct sulcation, there being on each elytron between the suture and the summit of the inflexed margin fourteen even and regular rows of small, closely-set, rounded tubercles, which are shiny and bear very short depressed setæ; the interstices with a few scattered large round white scales. *Legs* thick, coarsely punctured, with long black setæ and a few larger white scales; tibiæ very strongly denticulate along their interior edges; posterior tarsi broad, the three basal joints subequal in length and breadth.

NAMAQUALAND: O'okiep (*L. Péringuey*).

TYPE in my collection.

The example upon which this species is founded was sent to me some years ago by Mr. Péringuey under the name of *albicinctus* Gyl. It is, however, abundantly distinct from that species, as an examination of the descriptions will show, though there is a superficial resemblance in general facies. From its much nearer ally *congestus* Mshl. it differs in the narrower and undulating rostral carinæ; in the double impression on the forehead; in the more rounded shape of both prothorax and elytra; in the complete absence of the prominence on the third interval of the latter; and in the much greater thickness of the legs.

16. †H. SUBCORDATUS Gyl.

H. subcaudatus Gyl. Schh. Gen. Curc. v. p. 782 (1840).

Head convex, dispersely punctured; forehead plane, rugose; anteocular furrows not very deep. *Rostrum* cut off from head by a deep dorsal incision, elongate, but yet a little shorter than thorax, deflected but scarcely curved, sides almost parallel throughout. Upper surface with five smooth even carinæ; lateral sulci deep, equal in length, the upper pair not uniting at base; scrobes deep, lateral and parallel to sulci; inferior basal furrow very deep. *Antennæ* with scape just reaching eye; the first joint of funicle a little longer than second. *Prothorax* elongate, as long as broad, length about equal to width at base, apex much narrower, sides subparallel from base to middle, then rapidly narrowed anteriorly, ocular lobes well developed. Upper surface convex, closely set with large rounded depressed tubercles; the central furrow obsolete; tubercles unipunctate, the interstices without scaling. *Elytra* heart-shaped, strongly acuminate behind, shoulders prominent, sides strongly rounded, broadest much before middle, apical processes very small, tuberculiform. Upper surface moderately convex, transversely rugose, with rows of large and remote but indistinct foveolæ; scaling absent, the elytra being bare, black and shiny. *Legs* elongate, rugose, with long black setæ; anterior pairs of tibiæ strongly curved; posterior tarsi broad, the three joints subequal in length and breadth.

"CAFFRARIA (*Drège*)"—*teste* Schönherr.

TYPE in the Stockholm Museum.

The only example of this peculiar species which I have been able to examine is Gyllenhal's unique type. The cordiform elytra and long legs give the insect a very distinct appearance, more suggestive of a Western *Adesmia* than a *Hipporrhinus*. It seems probable that its real habitat is somewhere in the North-western parts of the Cape Colony, and not Caffraria as stated by Schönherr.

17. H. ALBICINCTUS Gyl.

H. albicinctus Gyl. Schönh. Gen. Curc. v. p. 711 (1840).

Long. 21–22, lat. 10–10½ mm.

Head convex, finely shagreened on vertex, and with very deep scattered punctures; forehead flattened or shallowly impressed, very rugose, and with a low central carina; anteocular furrows present but not very distinct. *Rostrum* separated from head by a basal incision, as long as head and prothorax, curved beyond middle. Upper surface with five broad smooth carinæ, the central one usually bearing a faint stria, the intervening furrows coarsely punctured and with white scaling; lateral sulci deep, meeting at base, the upper pair rather longer; scrobes lateral, parallel to sulci; inferior basal furrow very broad and deep. *Antennæ* with fine white setæ; scape not reaching eye, the two basal joints of funicle subequal. *Prothorax* transverse, apex narrower than base,

sides not much rounded, broadest before middle, dorsal anterior margin truncate, ocular lobes well developed. Upper surface convex, very closely set with low rounded tubercles, without any central furrow; tubercles unipunctate, bare and without setæ, the interstices with scattered large round white scales, which are denser laterally and along a narrow central line. *Elytra* very broadly ovate, shoulders with a strong tubercular prominence projecting forwards, sides strongly rounded, broadest rather behind middle, apical prominences very short and obtuse in ♀. Upper surface convex, the sulci with rows of subreticulated foveolæ separated by transversely-elongated granules and disappearing near apex; all intervals evenly raised, except for an obtuse prominence on the declivity of 3, each with a row of small rounded tubercles, but those on intervals 1 and 2 are usually almost obliterated; tubercles bare and with minute black setæ, the sulci containing elongate patches of large round white scales, which are denser towards the sides. *Legs* short and stout, very rugosely foveate, and with a few scattered white scales; all the tibiæ with their interior edges strongly dentate; posterior tarsi with the joints subequal in length and breadth.

Cape Colony: Namaqualand (*L. Péringuey*).

Type in the Stockholm Museum.

Of this species Mr. Péringuey writes:—"I found this insect on a bush (*Rhus* sp.), with the black, white-spotted bark of which its colour harmonises so well; moreover, it always rests in the fork of a branch, where so closely does it resemble a knob of wood that I discovered it by mere chance. So well does it assimilate with its surroundings that I had to examine each branch of this *Rhus*, which was by no means plentiful, in order to obtain four or five specimens. So far from letting themselves fall when touched, these beetles clung tightly to the branches, and I could only detach them with difficulty. The curvature and toothing of the tibiæ were thus explained. The protective assimilation of this insect to its environment is one of the most striking cases that I have yet seen among South-African beetles."

18. H. janus Mshl. (Plate I. fig. 3.)

H. janus Mshl. l. c. p. 439 (1902).

Long. 19 (with apical spines, 20), lat. 8½ mm.

Head convex, with scattered shallow punctures on vertex, much deeper and coarser on forehead, which is retuse and has a short central carina; anteocular furrows deep. *Rostrum* cut off from head by a deep dorsal incision, as long as prothorax only, scarcely curved, subparallel for two-thirds of its length, thence dilated to apex. Upper surface convex, with five narrow and undulating carinæ, the central one being higher and rather shorter than the others; lateral sulci broad and deep, the lower pair longer, the upper pair meeting at base; scrobes sublateral, extending almost beneath the base of rostrum; inferior basal furrow deep. *Antennæ* with scape just reaching eye; the two basal joints of

funicle subequal. *Prothorax* a little broader than long, the length greater than the width at base, which is broader than apex; sides moderately rounded, broadest about middle; ocular lobes strongly developed. Upper surface slightly convex, closely set with small rounded tubercles having scarcely perceptible setæ, central furrow very narrow and without a carina; tubercles bare, shiny, the interstices with whitish scaling forming three ill-defined stripes. *Elytra* broadly ovate, shoulders prominent and subrectangular, sides very little dilated, broadest much before middle, apical processes very long and sharp. Upper surface convex, with shallow sulci containing regular rows of granules, which are very much reduced towards apex; the intervals with single rows of small tubercles, which are depressed and rather elongate in the dorsal area, but elevated towards the sides and apex; tubercles shining and mostly without setæ, the interspaces with scattered patches of whitish scaling, the scales being very large and circular. *Legs* with sparse white scaling and pale setæ; the three basal joints of posterior tarsi subequal in length and breadth, the onychium elongate, about equal to the three preceding joints together.

Cape Colony.

Type in the British Museum.

A very distinct species, superficially resembling *H. verrucellus* Gyl., but readily distinguished by the long apical spines, as well as by the presence of a strong central carina on the rostrum.

19. H. corpulentus Gyl.

H. corpulentus Gyl. Schh. Gen. Curc. v. p. 783 (1840).

Long. 14, lat. 7 mm.

Head convex, covered with large deep punctures, forehead deeply and longitudinally rugose; anteocular furrows distinct. *Rostrum* separated from head by a deep dorsal incision, thick and curved, shorter than prothorax. Upper surface with five strong narrow carinæ, the central one often bifid at apex, the interspaces with large shallow punctures; lateral sulci deep and distinct, of about equal length, the upper pair meeting at base; scrobes lateral and oblique; genæ strongly strigose; inferior basal furrow present. *Antennæ* with scape barely reaching eye; 1st joint of funicle a little longer than 2nd. *Prothorax* as long as broad, apex much narrower than base, sides slightly rounded, broadest behind middle, dorsal anterior margin slightly convex, ocular lobes very strong. Upper surface almost plane, densely and evenly set with large rounded granules without setæ; central furrow quite wanting; scaling absent. *Elytra* short ovate, jointly sinuate at base, shoulders prominent and subacute, sides moderately rounded, broadest about middle, apical processes minute. Upper surface convex, with indistinct sulci filled with rows of large granules; intervals all similar, each with a row of granules which are smaller and much more closely set than those in the sulci; scales sparse, large, round and whitish; some of the granules with short

depressed dark setæ. *Legs* very thick and coarsely punctured; the anterior pairs of tibiæ distinctly curved, and all of them strongly serrate on the inner edges; posterior tarsi short, the three joints subequal in length and breadth.

NAMAQUALAND: Bitterfontein.

TYPE in the Stockholm Museum.

A rare species. The sculpturing of the elytra much resembles that of *Brachycerus congestus* Gerst.

20. †H. CURTUS Gyl.

H. curtus Gyl. Schh. Gen. Curc. v. p. 785 (1840).

Long. 18, lat. 8 mm.

Head convex, with very deep punctures and scattered white scaling, forehead somewhat retuse and rugose, anteocular furrows present but not very distinct. *Rostrum* separated from head by a deep dorsal transverse incision, very short and thick, shorter than prothorax, strongly curved, dilated towards apex. Upper surface convex, very closely and coarsely punctured, with a broad smooth central carina which is bifid apically and bears a faint stria; upper lateral sulci broad and deep, uniting at base, lower ones shallow and much shorter; scrobes lateral, deep, and oblique; inferior basal furrow deep. *Antennæ* with pale recumbent setæ; scape barely reaching eye; the two basal joints of funicle subequal. *Prothorax* subglobose, as long as broad, apex much narrower than base, sides rounded, broadest about middle, dorsal anterior margin distinctly convex, ocular lobes prominent. Upper surface convex, closely set with low rounded tubercles, leaving a very narrow central furrow without any carina; tubercles bare, each with a depressed pale seta, the interstices fairly closely covered with pale round scales. *Elytra* shortly ovate, base strongly sinuate, shoulders sloping, sides rounded, broadest about middle, apical processes minute and tuberculiform. Upper surface convex and distinctly sulcate, the sulci containing rows of small granules; intervals all similar, costate, each with a row of larger but depressed granules, which are shining and bear depressed pale setæ; the interspaces unevenly clothed with large greyish scales. *Legs* thick, strongly punctured, and with scattered pale scaling and setæ; posterior tarsi short and broad, the joints subequal in length and breadth; tibiæ strongly serrate internally.

NAMAQUALAND: O'okiep (*L. Péringuey*).

The only example which I have seen of this insect is a ♀ in Mr. Péringuey's collection. Its only near ally is *H. corpulentus* Gyl., from which it may be distinguished not only by the very different sculpturing of the elytra, but also by its larger size, more rotund form, and much less strongly carinate rostrum.

21. †H. INFLATUS, sp. nov.

Long. 17, lat. 9 mm.

Head convex, deeply and rugosely punctured, forehead not flattened, without furrow or carina; anteocular furrows indistinct.

Rostrum separated from head by a deep transverse incision, as long as prothorax only, distinctly curved, sides subparallel throughout, but with the genæ slightly dilated. Upper surface convex, with five smooth, narrow, rather undulating carinæ; upper lateral sulci meeting at base, broader and rather longer than the lower pair; scrobes deep, lateral and oblique; inferior basal furrow very deep. *Antennæ* with grey setæ, scape just reaching eyes; the two basal joints of funicle subequal. *Prothorax* broader than long, apex narrower than base, sides not much rounded, broadest rather before middle, dorsal anterior margin truncate, ocular lobes moderate. Upper surface convex, without any central furrow, not very closely set with small rounded tubercles; each tubercle with a very short depressed pale seta, the interstices filled with brown scaling. *Elytra* very broad ovate, shoulders rounded but very prominent, the width there nearly twice as great as that of prothorax, sides rounded, broadest before middle, apical processes in ♀ short and tuberculiform. Upper surface convex, with regular shallow sulci containing rows of minute granules; intervals all similar, bearing regular and complete rows of large and often subconical granules; each granule with a depressed dark seta, the interspaces variegated with patches of large round brown scales. *Legs* stout, coarsely punctured, and with scattered pale setæ; the inner edges of the tibiæ strongly dentate, including the posterior pair; the posterior tarsi very setose, the joints subequal in length and breadth.

Cape Colony: Fraserburg (*E. G. Alston*).

Type in the South African Museum.

I have seen only a single ♀ of this very distinct species, which differs notably from the allied heavy-bodied species of the genus in the very small size of the prothorax as compared with the elytra.

22. H. bituberculatus Gyl.

H. bituberculatus Gyl. Schönh. Gen. Curc. i. p. 488 (1833).

H. costatus Gyl. t. c. p. 489 (1833).

H. punctirostris Gyl. op. c. v. p. 787 (1840).

Long. 14–19, lat. 5½–8½ mm.

Head convex on vertex, dispersely and faintly punctured, forehead with a shallow impression on either side; anteocular furrows short but distinct. *Rostrum* about as long as prothorax, cut off from head by a deep transverse basal incision, curved, gradually dilated towards apex. Upper surface with five low strongly punctured carinæ (sometimes the central one is less punctate than the others); lateral sulci deep, about equal in length, the upper pair uniting at base; scrobes broad and deep, lateral but oblique; inferior basal furrow very deep. *Antennæ* with scape scarcely reaching eye; the two basal joints of funicle subequal. *Prothorax* distinctly transverse, apex rather narrower than base, sides strongly rounded, broadest rather behind middle, dorsal anterior margin truncate, ocular lobes slight. Upper surface convex, with a

shallow transverse impression behind apex, closely set with low rounded tubercles, leaving a narrow but deep central furrow containing no carina; tubercles bare, shiny, each with a short depressed seta, the interstices with dense brown scaling. *Elytra* oblongo-ovate, narrower in ♂, shoulders sloping, sides slightly rounded, broadest about middle, apical processes (in ♀ only) normally short, blunt and porrect, but variable and sometimes entirely absent. Upper surface with shallow sulci containing rows of ill-defined punctures separated by small granules; the intervals all closely and evenly granulate, 3, 5, and 7 being usually slightly more prominent than the others, but in some examples this is scarcely noticeable; in interval 3 with a small tubercular prominence at the top of the declivity, which is variable in size and sometimes absent; apices of granules bare, each with a depressed seta, interspaces with fairly dense small brown scaling. *Legs* distinctly thicker in ♂ than in ♀, with sparse brown scaling; posterior tarsi with the 3rd joint a little broader than the others, 2nd and 3rd subequal in length, 1st rather longer.

Cape Colony: Port Elizabeth (*Dr. H. Brauns*), Uitenhage (*Rev. J. A. O'Neil*), Willowmore (*Dr. Brauns*), Kowie and Kei River [S. A. Mus.].

Type in the Stockholm Museum.

I can detect no difference whatever between the types of *costatus* and *bituberculatus*. *H. punctirostris* appears to differ only in its more even elytral intervals and in the absence of the apical processes in the ♀. These characters are, however, certainly variable, and I have seen several intermediate examples which render it impossible to regard the two forms as specifically distinct.

Father O'Neil writes of this species that it is common at Uitenhage and Grahamstown throughout the year, being generally found under stones on rich soil, but sometimes under dead leaves and humus.

23. H. angustus, sp. nov. (Plate I. fig. 5.)

Long. 11–12½, lat. 4–5 mm.

Head convex, rugosely punctured, and with sparse depressed pale setæ, forehead not flattened, but plicate and with a deep impression just above each eye; anteocular furrows almost obsolete. *Rostrum* a little shorter than head and prothorax, with a transverse dorsal incision at base, distinctly curved, rather thicker in ♀. Upper surface convex, with five narrow smooth carinæ, the central one being a little higher than the others, the intervening sulci closely punctured and clothed with brown setæ; lateral sulci deep, meeting at base, about equal in length; scrobes entirely lateral, subparallel with the sulci; inferior basal furrow deep. *Antennæ* with fine whitish pubescence; scape just reaching eye; the two basal joints of funicle subequal. *Prothorax* as long as broad in ♂, slightly transverse in ♀, apex narrower than base, with a shallow constriction just behind apex, dorsal

anterior margin almost concave, ocular lobes moderate. Upper surface convex, closely granulate, except for a very narrow central furrow containing no carina; granules bare at apex and with depressed pale setæ, interstices with dense brown scaling. *Elytra* elongato-ovate, very narrow in ♂, being scarcely broader than the prothorax, sides gradually rounded, broadest rather before middle, apical processes minute tuberculiform and widely separated in ♀, absent in ♂. Upper surface convex, the striæ with rows of shallow punctures; intervals each with a regular row of granules, those on 3, 5, and 7 being a little more prominent than the others; interval 3 with a single granule on the declivity larger than the others; granules with their apices only bare and with pale depressed setæ; scaling dense, uniform earthy brown. *Legs* with fine white setæ, forming a denser ring near apex of femora; posterior tarsi rather narrow, 3rd joint slightly broader than the others, 2nd and 3rd subequal in length, 1st longer.

Cape Colony: Algoa Bay (*Dr. H. Brauns*).

Type in the British Museum.

This species, of which Dr. Brauns has kindly sent me five specimens, is like a very small and narrow *bituberculatus*, but in addition to the differently shaped prothorax it may be distinguished by the plicate forehead, which is not impressed as in that species.

24. H. capensis (L.).

Curculio capensis L. Mus. Lud. Ulr. p. 59 (1764); Herbst, Col. vi. p. 286, t. 82. f. 3 (1797); Sparrm. Act. Holm. i. p. 48, t. 2. f. 16 (1785); Ol. Ent. v. 83, p. 393, t. 5. f. 52 & t. 9. ff. 109, 110 (1807).

H. capensis Gyl. Schh. Gen. Curc. i. p. 483 (1883).

? *Curculio capistratus* F. Mant. i. p. 120 (1787).

? *H. capistratus* Gyl. op. c. v. p. 786 (1840).

Long. 14–20, lat. 5–8½ mm.

Head closely and deeply punctured, with sparse brownish scaling, vertex convex, forehead retuse; anteocular furrows deep. *Rostrum* separated from head by a deep dorsal incision, almost as long as head and prothorax, thick, strongly curved, and scarcely dilated at apex. Upper surface rugosely punctured and with thin pale scaling, with five strong carinæ, the central one smooth and the others coarsely punctured; lateral sulci deep, of equal length, the upper pair uniting at base; scrobes deep, lateral and parallel with sulci; inferior basal furrow very deep. *Antennæ* with dense, fine, grey scaling; scape barely reaching eye; the two basal joints of funicle subequal. *Prothorax* as long as broad in ♂, transverse in ♀, apex narrower than base, sides rounded, broadest about middle in ♂, behind middle in ♀, dorsal anterior margin truncate or very slightly convex, ocular lobes well developed. Upper surface convex, closely set with low rounded granules, leaving a very narrow and often ill-defined central furrow; granules bare, each with a minute depressed seta, the interstices with brown or greyish scaling. *Elytra* ovate in ♀, very narrow

in ♂, shoulders sloping, sides slightly rounded, broadest about middle, apical processes absent in ♂, shortly conical, and often rudimentary, in ♀. Upper surface convex, with distinct sulci containing rows of ocellated punctures, usually with small intervening granules; each interval has a complete row of small closely-set shiny granules, bearing very short depressed pale setæ; the interspaces with dense brown scaling variegated with small spots of white; in the ♀ the first interval is more or less distinctly elevated on the declivity. *Legs* with fine grey scaling and a narrow paler ring near apex of femora; the three basal joints of posterior tarsi subequal in length and breadth.

Cape Colony: Willowmore (*Dr. H. Brauns*), Kenhardt and Carnarvon [S. A. Mus.].

As I have been unable to examine the type of *capistratus* F., I cannot feel quite certain as to its identity with *capensis* L. But so far as Gyllenhal's descriptions of the two forms are concerned, I am unable to find any valid specific differences between them. In the general collection at Stockholm there is a single ♂ under each name, but the specimens are unquestionably conspecific. Schönherr had only one ♂ *capensis* in his collection. Gyllenhal's description of *capistratus* ♂ was made from an example in Chevrolat's collection, but I was unable to find the insect in Chevrolat's boxes at Stockholm. However, in his notes Mr. Péringuey mentions having examined this very specimen, and he considered it inseparable from *capensis*. The form which I attribute to *capistratus* is a much bigger and broader insect than typical *capensis*, the rostrum is more strongly curved, and the legs are much stouter, especially in some ♂ examples. But these characters all vary into those of *capensis*, and in a large series of specimens which I have seen it has been impossible to draw any dividing line between the two forms.

25. H. PÉRINGUEYI, sp. nov. (Plate I. fig. 4.)

Long. 20–22, lat. 7–8 mm.

Head very convex, with deep scattered punctures, forehead strongly retuse; anteocular furrows deep. *Rostrum* very thick, rather longer and narrower in ♂, a little longer than prothorax, distinctly curved and cut off from head by a deep dorsal incision. Upper surface rather convex, with five broad carinæ of equal height and width, the central one smooth, the others strongly punctured, the intervening furrows filled with white scaling; lateral sulci deep and subequal in length and breadth; scrobes lateral, deep, straight and almost parallel to the sulci; inferior basal furrow very broad and deep. *Antennæ* with fine pale pubescence; scape scarcely reaching eye; the 1st joint of funicle a little longer than 2nd. *Prothorax* as long as broad, apex a little narrower than base, sides moderately rounded, broadest about middle, dorsal anterior margin slightly convex, ocular lobes strongly developed. Upper surface convex, very closely set with low rounded tubercles, leaving a scarcely distinguishable central

furrow; tubercles bare, each with a very short depressed dark seta, the interstices with sparse white scaling. *Elytra* narrowly ovate in ♀, much narrower and more oblong in ♂, shoulders sloping, sides not much rounded, broadest before middle, a low tuberculate intra-apical callus on each side, which is more prominent in ♀. Upper surface convex, the sulci with regular rows of distinct punctures; the intervals all similar, each with a row of large closely-set granules, which are shiny, each having usually a very short dark depressed seta, the interspaces with scattered spots of round whitish scales. *Legs* with sparse white scaling, forming a denser ring near apex of femora; anterior tibiæ distinctly sinuate externally in ♂, simply curved in ♀, posterior pair not denticulate internally in either sex; posterior tarsi with joints of equal width, 2nd and 3rd subequal in length, 1st slightly longer.

NAMAQUALAND: O'okiep (*L. Péringuey*).

TYPE, ♂ in the British Museum, ♀ in the South African Museum.

Probably the Namaqualand representative of *H. capensis* L., from which, however, it differs much in appearance, owing to its large size and elongate shape; the external sinuation in the anterior tibiæ of the ♂ is an unusual character.

26. H. LACUNOSUS Gyl.

H. lacunosus Gyl. Schh. Gen. Curc. i. p. 485 (1833), v. p. 789 (1840).

Long. 18, lat. 8¼ mm.

Head very convex, punctuation faint, close on vertex but diffuse in front; forehead with a shallow central depression; eyes surrounded by a narrow impressed ring; anteocular furrows distinct. *Rostrum* cut off from head by a deep dorsal incision, thick and strongly curved, as long as prothorax only. Upper surface with five smooth narrow carinæ, the interspaces indistinctly punctured and with short pale setæ; lateral sulci deep, the upper and lower pairs of equal length, the former uniting at base; scrobes lateral, subparallel to the sulci; inferior basal furrow very deep. *Antennæ* piceous, finely pubescent; the scape just reaching eye; the 1st joint of funicle longer than 2nd. *Prothorax* distinctly transverse, base and apex of equal width, sides strongly rounded, broadest about middle, dorsal anterior margin truncate, ocular lobes feeble. Upper surface rather convex, closely set with low rounded tubercles, leaving a narrow central furrow without a carina; tubercles bare, each with a very short pale depressed seta; interstices with dense yellowish scaling. *Elytra* oblongo-ovate, shoulders roundedly prominent, sides scarcely rounded, broadest about middle, apical processes absent. Upper surface convex, with shallow sulci containing faint punctures separated by intervening granules; intervals all similar, bearing single rows of depressed granules, each having a short pale seta; the suture strongly raised on the declivity only; scaling fairly dense, variegated light brown and whitish. *Legs* with sparse pale setæ,

forming a denser ring near apex of femora; posterior tarsi with joints of the same width, 2nd and 3rd subequal in length, 1st a little longer.

CAPE COLONY.

TYPE in the Stockholm Museum.

27. H. CRINIGER Mshl. (Plate I. fig. 8.)

H. criniger Mshl. l. c. p. 441 (1902).

Long. 16, lat. 6–7 mm.

Head very convex, punctuation on vertex close but shallow, deeper and more scattered in front, forehead retuse and with a more or less distinct impression; anteocular furrows deep and complete. *Rostrum* about as long as prothorax only, cut off from head by a deep dorsal incision, stout, strongly curved, sides subparallel to beyond middle, then gently dilated to apex. Upper surface convex, with five strong carinæ which are generally smooth and shiny; lateral sulci broad and deep, the upper pair rather longer and alone meeting at base; scrobes deep, lateral and oblique; inferior basal furrow very deep. *Antennæ* with scape just reaching eye; the two basal joints of funicle subequal. *Prothorax* distinctly transverse, the length about equal to the width at base, apex scarcely narrower, sides strongly rounded, broadest a little behind middle, dorsal anterior margin truncate, ocular lobes moderately prominent. Upper surface almost plane, closely set with round flattened tubercles, leaving a narrow central furrow without a carina; tubercles bare and without setæ, the interstices with dense brown scaling. *Elytra* oblongo-ovate, much narrower in ♂, shoulders sloping, sides scarcely rounded, apical processes absent in both sexes, the sutural part slightly raised on the declivity in the ♀ only. Upper surface slightly convex, striæ with regular rows of shallow punctures separated by small granules, alternate intervals more prominent; intervals 1, 3, 5, and 7 with elongate depressed shiny tubercles, each bearing a very long erect black seta; intervals 2, 4, and 6 with rows of small closely-set granules, each bearing a very short depressed pale seta; tubercles and granules bare, the interspaces with dense brown scaling more or less variegated with small white patches. *Legs* with close pale pubescence, slightly thicker near apex of femora; 2nd joint of posterior tarsi shorter than 1st, of equal length to, but narrower than, 3rd.

CAPE COLONY.

TYPE in the British Museum.

Entirely resembling *H. lacunosus* Gyl. in general facies, but in that species the intervals on the elytra are uniform and the granules are subequal throughout, there being no elongate tubercles; moreover, the erect black setæ are specially characteristic of *criniger*.

28. H. DECEPTOR Mshl. (Plate I. fig. 7.)

H. deceptor Mshl. l. c. p. 447 (1902).

Long. 13-15, lat. 6–7 mm.

Head convex, with sparse punctures and squamæ, forehead with a rounded impression; anteocular furrows distinct. *Rostrum* separated from head by a deep dorsal incision, as long as head and prothorax, thick, strongly curved and slightly dilated near apex. Upper surface with five strong smooth narrow carinæ of even height; lateral sulci of about equal length, the upper pair rather deeper and meeting at base; scrobes deep, lateral and oblique; inferior basal furrow very deep. *Antennæ* with scape barely reaching eye; the two basal joints of funicle subequal. *Prothorax* transverse, more distinctly so in ♀, the length equal to the width at base in ♀, greater in ♂; apex rather narrower than base, sides strongly rounded, broadest about middle, dorsal anterior margin truncate, ocular lobes moderate. Upper surface rather convex, closely set with small elevated granular tubercles, leaving a narrow central furrow without a carina; tubercles bare and with very short depressed setæ, the interstices with dark scaling and three narrow pale lines. *Elytra* ovate, much narrower in ♂, shoulders roundedly prominent, sides distinctly rounded, broadest about middle, apical processes very small and contiguous in both sexes. Upper surface convex, distinctly sulcate, sulci with rows of shallow punctures separated by small granules; intervals all evenly raised, subcostate, and with regular rows of large shiny granules, each bearing a depressed dark seta, the interspaces with uneven scaling, being variegated with small patches of brown, fulvous, or white. *Legs* piceous, with fine pale pubescence; posterior tarsi with the 2nd joint a trifle narrower than the others, 2nd and 3rd subequal in length, 1st longer.

Cape Colony: Port Elizabeth (*Dr. H. Brauns*).

Type in the British Museum.

From the allied *H. lacunosus* Gyl. this insect differs in its thinner, deeply sulcate and less curved rostrum; the thoracic tubercles are not depressed; the sides of the elytra are more ampliated, and in the ♀ the suture is not nearly so much elevated on the declivity.

29. H. sparsus Mshl. (Plate I. fig. 6.)

H. sparsus Mshl. l. c. p. 448 (1902).

Long. 12, lat. 6 mm.

Head convex, bare, and with faint scattered punctures, forehead with a slight central depression; anteocular furrows deep and complete. *Rostrum* as long as head and prothorax, cut off from head by a deep dorsal incision, distinctly curved and very gradually dilated from base to apex. Upper surface nearly plane, with three fine carinæ, the central one being the shortest and vanishing beyond middle; punctuation indefinite, scaling absent; lateral sulci broad and deep, separated by a strong costa bearing a faint stria, the upper pair only meeting at base; scrobes straight and lateral, almost parallel to the sulci; inferior basal furrow very deep. *Antennæ* with scape just reaching eye; the two basal joints of funicle subequal. *Prothorax* slightly transverse, the

length greater than the width at base, which is equal to the apex, sides strongly rounded, broadest about middle; ocular lobes moderately developed. Upper surface slightly convex, closely set with small elevated shiny tubercles, leaving a very narrow central furrow without a carina; tubercles bare, with short depressed setæ, the interstices with sparse brown scaling. *Elytra* oblongo-ovate, shoulders roundedly prominent, much broader than the base of prothorax; sides not much rounded, broadest before middle; apical processes absent in ♀. Upper surface slightly convex, with shallow closely-punctured striæ; intervals with small rather distant tubercles, which are somewhat depressed dorsally and near base, but conical towards sides and apex; intervals 2, 4, and 6 with the tubercles more distant than on the others; interval 1 slightly raised on the declivity in the ♀ and with the tubercles there closely set; tubercles with a short apical seta; elytra bare except for a few small scattered patches of yellowish scales. *Legs* with fine pale scaling; 2nd and 3rd joints of posterior tarsi subequal in length.

CAPE COLONY.

TYPE in the British Museum.

The larger and more distant tubercles on the elytra, as well as the comparative narrowness of the prothorax, give this species a very different appearance from its nearest ally, *H. deceptor* Mshl.

30. H. SUTURALIS, sp. nov. (Plate I. fig. 9.)

Long. 19, lat. 8 mm.

Head very convex, with shallow punctuation, which is close on vertex but sparse in front, forehead with a shallow depression; eye surrounded by a deep impressed ring; anteocular furrows distinct. *Rostrum* cut off from head by a deep dorsal incision, as long as prothorax only, thick and strongly curved. Upper surface convex, with five strong smooth carinæ, all evenly raised, the furrows coarsely punctured; lateral sulci deep, the upper pair meeting at base and much longer than the lower; scrobes lateral, rather sinuate; inferior basal furrow distinct. *Antennæ* with the scape barely reaching eye; the two basal joints of funicle subequal. *Prothorax* distinctly transverse, apex narrower than base, sides strongly rounded, broadest about middle, dorsal anterior margin truncate, ocular lobes small but distinct. Upper surface almost plane, closely set with low rounded tubercles, leaving a narrow central furrow without any carina; tubercles bare and with scarcely perceptible setæ. *Elytra* obovate, shoulders prominent but rounded, sides evidently rounded, broadest behind middle, apical processes absent. Upper surface slightly convex, strongly sulcate, the sulci with rows of shallow punctures separated by distinct granules; intervals all evenly costate, not tuberculate, but transversely rugose, except close to apex, where they are more or less distinctly granulate; the suture distinctly raised on the declivity in the ♀ and set with a row of short erect black setæ; scaling absent, being replaced by short depressed yellow setæ,

which are usually abraded at base and on disk, but dense towards sides and apex. *Legs* with sparse pale pubescence; posterior tarsi spongy beneath, the 2nd joint slightly narrower than the others, 2nd and 3rd subequal in length, 1st a little longer.

CAPE COLONY.

TYPE in the British Museum.

In the first section of the genus the only species with setose, as opposed to squamose, elytra are *setiferus* Gyl., *suturalis* Mshl., and *granulatus* Gyl. The former is at once separated by the uneven intervals on the elytra. *H. granulatus* differs from *H. suturalis* in having the lateral sulci on the rostrum of equal length; the prothorax is much more transverse, with the sides more strongly dilated, while the ocular lobes are almost obsolete and the tubercles are more depressed and further apart; on the elytra the sulci are less deep, the granules in them much larger, the intervals all strongly granulate, and the general shape is more elongate. In general facies this species most nearly resembles *H. lacunosus* Gyl.

31. H. GRANULATUS Gyl.

H. granulatus Gyl. Schh. Gen. Curc. v. p. 792 (1840).

Long. 15–17, lat. 7–7½ mm.

Head very convex, strongly punctured, forehead retuse and with a shallow central impression; eyes surrounded by an impressed ring; anteocular furrows deep. *Rostrum* with a very deep dorsal incision at base, scarcely shorter than head and prothorax, very thick and strongly curved. Upper surface with five strong carinæ, the central one being the highest and quite smooth, the outer ones strongly punctured on their inner surfaces; lateral sulci deep, subequal, the upper pair meeting at base, the lower pair rather broader; scrobes straight, entirely lateral and parallel with the sulci; inferior basal furrow very deep. *Antennæ* with sparse pale setæ; scape just reaching eye; the two basal joints of funicle subequal. *Prothorax* very transverse, apex narrower than base, sides very strongly rounded, broadest about middle, anterior margin rather concave, ocular lobes slight. Upper surface plane, fairly closely set with low rounded tubercles, leaving a narrow ill-defined central furrow containing a scarcely noticeable carina; tubercles bare, with depressed pale setæ, interstices with thin pale hair-like scaling. *Elytra* broadly ovate, shoulders roundedly prominent, sides slightly rounded, broadest about middle, apical processes in ♀ cylindrical, short and parallel. Upper surface rather convex, sulcate, sulci with regular rows of small granules; intervals all similar, each with a single regular row of larger granules of about the same size throughout; granules bare, with short pale depressed setæ, interstices with thin pale hair-like scaling. *Legs* with sparse pale scaling; posterior tarsi with the 3rd joint broadest, 2nd and 3rd subequal in length, 1st distinctly longer.

CAPE COLONY.

TYPE in the Stockholm Museum.

32. H. GRANULOSUS Thunb.

H. granulosus Thunb. Nov. Act. Ups. vii. p. 120 (1815); Gyl. Schh. Gen. Curc. i. p. 484 (1833), v. p. 792 (1840).

Long. 14–15, lat. 5½–6 mm.

Head very convex, bare, closely and strongly punctured, forehead with a very deep longitudinal impression on each side; anteocular furrows present, but rather indistinct. *Rostrum* cut off from head by a deep basal incision, very short and thick, not more than two-thirds the length of prothorax, distinctly curved. Upper surface almost plane, very rugosely punctured, and with a strong smooth central furrow; upper lateral sulci broad and deep, uniting at base, lower sulci very short and subtriangular; scrobes lateral and oblique; inferior basal furrow broad and deep. *Antennæ* with scape just reaching eye; the two basal joints of funicle subequal. *Prothorax* transverse, apex narrower than base, sides very strongly rounded, broadest about middle, anterior margin slightly convex, ocular lobes well developed. Upper surface almost plane, closely set with low rounded tubercles, leaving a narrow indistinct central furrow without any carina; tubercles unipunctate but usually without setæ, interstices with only a very few widely-separated white scales. *Elytra* oblongo-ovate, rather broader in ♀, shoulders roundedly prominent, sides subparallel to beyond middle, apical processes absent. Upper surface convex, sulcate, sulci containing rows of distinct granules, but in some cases the granules join the intervals on either side, so that the sulci then appear to contain rows of large subreticulate foveæ; intervals all similar, each bearing a single regular row of low rounded tubercles, which are apt to become catenulate on disk; tubercles bare and without setæ, interstices with very few small and widely-separated white scales. *Legs* with a few sparse white scales; posterior tarsi with joints of the same width; 2nd and 3rd subequal in length, 1st a little longer.

CAPE COLONY: Hex River, Constantia.

Its remarkably short rostrum will immediately distinguish this species from any other in the genus. In some examples the sculpturing of the head is much more rugose and the two longitudinal impresssions are then not noticeable. One such example in the South African Museum is much larger than usual, and the reticulations on the elytra are also very much larger, giving the insect a very different appearance. But without further material it seems advisable to regard this as merely a varietal form.

33. †H. AURIVILII Pér.

H. aurivilii Pér. Trans. S. A. Phil. Soc. 1888, p. 171.

Long. 24, lat. 11 mm.

Head closely and finely punctured and covered with fulvous scaling; forehead broadly and deeply excavate; anteocular furrows distinct. *Rostrum* as long as head and prothorax, not incised at base, distinctly curved, strongly dilated near apex. Upper surface

with a deep central furrow, which is narrow in the middle, dilated towards apex, and still more so basally, where it merges into the excavation of the forehead; scaling dense, fulvous, and with conspicuous large scattered punctures; upper lateral sulci absent, lower pair shallow; scrobes directed beneath base of rostrum; inferior basal furrow present. *Antennæ* short, scape scarcely reaching eye; the two basal joints of funicle subequal. *Prothorax* scarcely longer than the width at base, apex narrower, sides dilated before middle into a strong recurved spine, anterior margin convex, ocular lobes moderate. Upper surface somewhat convex, with a deep central furrow, bordered by a tubercular costa in its anterior half and containing a strong smooth carina; the lateral portions are rather sparsely set with small rounded tubercles; costæ and tubercles bare, the interstices with dense fulvous scaling. *Elytra* ovate, broadest about middle, shoulders roundedly prominent, apical processes in ♀ long, stout and sharp. Upper surface convex, irregularly and transversely subreticulate, the intervals 3, 5, and 7 more raised than the others, subcostate, but more or less distinctly tuberculate towards apex; the remaining intervals with interrupted and incomplete rows of depressed tubercles. Tubercles bare and shiny, the interspaces densely covered with small fulvous scales. *Legs* variegated with pale scaling; posterior tarsi broad, spongy beneath, the joints of the same width, 2nd and 3rd of equal length, 1st rather longer.

Transvaal: Rustenburg.

Type in Mr. Péringuey's collection.

The sculpturing of the elytra differs very markedly from that of the other large species which have lateral spines on the prothorax.

34. H. severus Gyl.

H. severus Gyl. Schönh. Gen. Curc. v. p. 747 (1840).

Long. 23–29, lat. 9–12 mm.

Head convex, with close shallow punctuation and fulvous scaling, forehead without fovea or carina; anteocular furrows deep, subconvergent above. *Rostrum* not incised at base, as long as head and prothorax, strongly curved and dilated from middle to apex. Upper surface with a deep central furrow throughout, dilated anteriorly and containing a distinct rounded impression at base; the furrow impunctate, but the adjoining costæ coarsely punctured and with scattered large white scales; upper lateral sulcus absent, the lower one deep and distinct; scrobes deep, directed beneath base of rostrum; inferior basal furrow present. *Antennæ* with scape not nearly reaching eye; the two basal joints of funicle subequal. *Prothorax* transverse, the length equal to width at base, apex narrower, sides ampliated and armed about middle with a sharp tubercular spine, dorsal anterior margin convex, ocular lobes moderate. Upper surface somewhat convex, with a tubercular callus along apex, sparsely set with large rounded tubercles, leaving a broad central furrow containing a short low

carina; tubercles bare, sometimes with minute setæ, the interstices with dense fulvous scaling, the central furrow and sides paler. *Elytra* ovate, narrower in ♂, shoulders sloping, sides rounded, broadest about middle, apical processes short and sharply conical in both sexes. Upper surface convex, with regular rows of distinct granules which often vanish towards apex; the intervals with rows of large, but variable, rounded tubercles which become conical posteriorly; those on intervals 2, 4, and 6 usually more widely separated than the others; tubercles never cristate on the declivity, bare, shiny, and with very short depressed setæ, the interspaces with dense fulvous scaling becoming paler laterally, and sometimes with a large pale patch on the declivity. *Legs* with scattered round white scales and depressed black setæ; posterior tarsi broad, the joints of the same width, 2nd and 3rd of equal length, 1st longer.

Natal: Malvern (*C. N. Barker*), Estcourt. Transvaal: Lydenburg (*Dr. Gunning*), Barberton (*Dr. P. Rendall*), Zoutpansberg (*Kaessner*). Orange River Colony: Kronstad [S. A. Mus.]. Port. E. Africa: Delagoa Bay (*H. Junod*).

Type in the Stockholm Museum.

A common arboreal species throughout the South-eastern districts of South Africa. The typical form, which in most collections stands under Boheman's MS. name *tuberculatus*, has the elytral tubercles more evenly distributed and approximately of more equal size throughout, the colouring is also of a more greyish brown and without paler patches; this form is most prevalent on the coast and in the more low-lying inland localities. The high veldt form has the scaling more markedly fulvous in colour and usually with two large pale patches on the declivity, the tubercles on intervals 3 and 5 are much smaller and more closely set, those on 2 and 4 being larger and often widely separated; this form is also of rather more robust habit, but the differences mentioned are very variable and cannot be regarded as of specific value.

35. †H. variegatus, sp. nov.

Long. 20, lat. 9 mm.

Head convex, obscurely punctured and with depressed fulvous setæ, base of rostrum produced acutely on to the forehead; anteocular furrows very deep, approaching very closely above in an oblique direction. *Rostrum* not incised transversely at base, longer than head and prothorax, strongly curved and dilated at apex only. Upper surface shallowly punctured and sparsely setose, plane or slightly convex, with a shallow impression near apex, a very deep elongate fovea at base, and a faint smooth central carina; upper lateral sulci obsolete, the lower pair deep and curved upwards at base; scrobes deep, directed beneath base of rostrum; inferior basal furrow shallow. *Antennæ* with scape barely reaching eye; the two basal joints of funicle subequal. *Prothorax* longer than its width at base, which is broader than

the apex, sides strongly ampliated and produced about middle into a stout tubercular spine, dorsal anterior margin convex, ocular lobes well developed. Upper surface somewhat convex, fairly closely set with large rounded tubercles, leaving a deep central furrow containing an abbreviated carina, anterior margin with a low tubercular callus; tubercles bare, shiny, each with a depressed dark seta, the scaling in the interstices fulvous, except in the central furrow and on the sides of the prosternum, where it is white. *Elytra* oblongo-ovate, shoulders roundedly prominent, sides slightly ampliated, broadest about middle, apical processes (in ♂) short and bluntly conical. Upper surface convex, with regular rows of distinct separated granules; interval 1 with a complete row of distant tubercles, becoming very much smaller behind middle; interval 2 with only an apical, subcristate row of small conical tubercles; 3, 5, and 7 with rows of small separated conical tubercles, that on 3 ceasing abruptly at the top of the declivity; 4 and 6 devoid of tubercles, or at most with one or two isolated ones; tubercles bare, shiny, with depressed dark setæ, the interspaces with sparse fulvous scaling, which is denser and brighter on the inflexed margins, and with a large transverse paler patch at the top of the declivity. *Legs* with depressed pale fulvous setæ and a ring of white scales near the apex of the posterior pairs of femora; posterior tarsi broad, the three basal joints subequal in length and breadth.

South Africa.

Type in the South African Museum.

This species is in some respects intermediate between *H. severus* and *H. pilularius*. It resembles the latter in having the tubercles on the second interval of the elytra distinctly cristate on the declivity and also in the banding of the femora; but the rostral characters are much nearer those of *severus*, especially the anteocular furrows, which are long, deep, oblique, and dorsally convergent.

36. H. pilularius (F.).

Curculio pilularius F. Mant. i. p. 121 (1787); Ol. Ent. v. 83, p. 391, t. 15. f. 188 (1807); Herbst, Col. vi. p. 305, t. 84. f. 2 (1797).

H. pilularius Gyl. Schönh. Gen. Curc. i. p. 460 (1833), v. p. 746 (1840).

Curculio armillatus Sparrm. Act. Holm. (1785) i. p. 44?

H. pastillarius Gyl. op. c. i. p. 462 (1833).

H. turpis Schh. Gen. Curc. i. p. 465 (1833).

Long. 20–27, lat. 8–12 mm.

Head convex, faintly and dispersely punctured, with thin greyish scaling on vertex; forehead bare and with a fine central stria, sometimes reduced to a mere fovea; anteocular furrows deep. *Rostrum* without a basal incision, as long as prothorax, distinctly curved and gradually dilated to apex. Upper surface plane or slightly convex in the basal part, broadly but shallowly excavate

anteriorly, smooth in the centre and with scattered punctuation laterally; upper lateral sulcus very faint and punctate, the lower sulcus much broader, deeper, and longer; scrobes deep, directed beneath base of rostrum; inferior basal furrow deep. *Antennæ* with sparse grey setæ; scape not reaching eye; the two basal joints of funicle subequal. *Prothorax* rather longer than the width at base, apex narrower, sides strongly dilated and produced into an obtuse tuberculated spine, anterior margin convex, ocular lobes well developed. Upper surface moderately convex, irregularly set with large rounded tubercles, leaving a distinct central furrow containing an abbreviated carina; the tubercles bare, shiny, each with a very short depressed seta, the interstices with dense greyish scaling. *Elytra* oblongo-ovate, much narrower in ♂, shoulders sloping, sides slightly ampliated, broadest about middle, apical processes short, acute, and divaricating in both sexes. Upper surface convex, with fairly regular rows of small granules in lieu of punctures; intervals uneven, the first with a row of small tubercles, becoming much smaller near apex; 2, 3, 5, and 7 with complete rows of larger tubercles, which are low and rounded on the disk, but become conical towards the apex and sides, those on interval 2 being strongly cristate on the declivity; intervals 4 and 6 devoid of tubercles or with abbreviated or interrupted rows; tubercles bare, shiny, with short depressed setæ, the interspaces more or less densely covered with small greyish scaling, usually in patches and often much abraded. *Legs* finely punctured, with sparse pale scaling, forming a denser ring near apex of femora; posterior tarsi broad, the joints of about the same width, 2nd and 3rd subequal in length, 1st a little longer.

Cape Colony: Port Elizabeth (*Dr. Brauns*), Grahamstown (*Rev. J. A. O'Neil*), Cape Town, George, and Beaufort West [S. A. Museum].

I am not certain as to the whereabouts of the type; the type of *pastillarius* is at Stockholm.

Of this species Father O'Neil writes me that it "is fairly common in the neighbourhood of Grahamstown, where it is usually taken on sandy roads and pathways. At Dunbrody [Uitenhage] I have only taken it once, when I came across a whole family of about twenty of these insects (all totally black) on bushes." The form described by Gyllenhal as *pastillarius* is merely a variation in which the tubercles on intervals 4 and 6 of the elytra are absent. Fabricius' *H. globifer* "var. thorace utrinque unispinoso" was referred by Schönherr with doubt to *condecoratus* Gyl.; the specimen is, however, in the Banksian Collection, with the type of *globifer*, and is certainly referable to this species.

37. H. furvus Fåhr.

H. furvus Fåhr. Öfv. K. Vet.-Ak. Förh p. 205 (1871).

Head convex, obscurely punctured and covered with fulvous scaling; anteocular furrows deep, subconvergent above. *Rostrum* not incised dorsally at base, as long as head and prothorax, stout,

curved and dilated towards apex. Upper surface almost plane at base, or with a faint central furrow which broadens and deepens towards apex, closely but shallowly punctured and with sparse fulvous scaling; lateral sulci not uniting at base, of about equal length, but the lower much broader and deeper than the upper; scrobes deep, directed beneath base of rostrum; inferior basal furrow distinct. *Antennæ* comparatively short, the scape not nearly reaching the eye; the two basal joints of funicle subequal or with the first joint slightly longer. *Prothorax* a little longer than the width at base, apex narrower, sides slightly dilated and with a sharp spine before middle, dorsal anterior margin truncate, ocular lobes well developed. Upper surface slightly convex and with a more or less distinct transverse impression near apex, moderately closely set with large rounded tubercles, leaving a broad shallow central furrow containing a short carina; tubercles bare, each with a very short depressed dark seta, the interstices with dense fulvous or greyish scaling. *Elytra* oblongo-ovate, shoulders sloping, sides moderately rounded, broadest about middle, apical processes sharply conical and divergent in ♀, blunt and much shorter in ♂. Upper surface convex, with regular rows of distinct granules instead of punctures, the intervals evenly raised; interval 1 granulate; 2 with an interrupted row of tubercles which become larger and subcristate on the declivity; 3, 5, and 7 with complete, and usually duplicated, rows of rounded tubercles which become more conical apically; 4 and 6 with only a few isolated tubercles; tubercles bare, usually with depressed pale setæ, the interspaces with rather thin tawny or greyish scaling and two conspicuous paler patches at the summit of the declivity. *Legs* with sparse pale scaling and a denser ring near apex of femora; posterior tarsi with the joints of about the same width, 2nd and 3rd subequal in length, 1st longer.

Cape Colony: Colesberg and Kimberley. Natal: Maritzburg. Transvaal: Johannesburg (*J. P. Cregoe*), Lydenburg and Rustenburg (*T. Ayres*). Orange River Colony: Bothaville (*Dr. Brauns*). Bechuanaland: Vryburg. Matabeleland: Bulawayo (*J. P. Cregoe*). Mashonaland: Salisbury, Umtali.

Type in the Stockholm Museum.

38. H. tenuegranosus Fairm.

H. tenuegranosus Fairm. Ann. Soc. Ent. Belg. 1893, p. 35.
H. viator Kolbe, Archiv Naturges. lxiv. p. 257 (1898).

Long. 20–25, lat. 8–10 mm.

Head convex, obscurely punctured, and with thin scaling; anteocular furrows very deep. *Rostrum* not incised at base, as long as head and prothorax, strongly curved and dilated towards apex. Upper surface obscurely punctured and with sparse scaling, almost plane at base, broadly but shallowly excavate towards apex; lateral sulci not united at base, the lower one rather longer and much broader and deeper than the upper; scrobes deep, directed beneath base of rostrum; inferior basal furrow absent. *Antennæ*

rather elongate, slender, scape nearly reaching eye; the two basal joints of funicle subequal. *Prothorax* a little longer than the width at base, apex narrower, sides slightly ampliated and armed with a sharp spine about middle, dorsal anterior margin slightly convex, ocular lobes well developed. Upper surface slightly convex, with a shallow transverse impression near apex, moderately closely set with large rounded tubercles, leaving a shallow central furrow containing a short carina; tubercles bare, with depressed pale setæ, the interstices with thin brownish scaling. *Elytra* oblongo-ovate, much narrower in ♂, shoulders sloping, sides scarcely rounded, broadest about middle, apical processes short and bluntly conical in ♀, rather longer and sharper in ♂. Upper surface convex, with rows of distinct granules instead of punctures; interval 1 granulate; 2 with a short subcristate row of tubercles on the declivity and with small depressed tubercles continuing interruptedly to base, though occasionally altogether absent; intervals 3, 5, and 7 with complete rows of small, closely set, subconical tubercles; 4 and 6 entirely devoid of tubercles or with a few isolated ones; tubercles bare, with depressed pale setæ, the interspaces with thin brownish-grey scaling and two paler patches at the top of the declivity. *Legs* rather long, with sparse pale scaling and a denser ring near apex of femora; posterior tarsi with the 3rd joint slightly broader than the other two, 2nd and 3rd subequal in length, 1st longer.

NYASALAND (*A. Whyte*). BRITISH EAST AFRICA: Lagari (*C. S. Betton*). "German East Africa: Mlalo, 1000 m. (*Holst*), Kilimanjaro, 2600–3000 m. (*Dr. Volkens*)"—teste *Kolbe*. "ABYSSINIA: Sciatolit (*Ragazzi*)"—teste *Fairmaire*.

Dr. Kolbe and Mons. Fairmaire compare this species respectively with *spectrum* Gyl. and *tuberculatus* Boh. MS. (=*severus* Gyl.), but it is still more closely allied to *furvus* Fåhr., of which I at first regarded it as a variety. However, the absence of the inferior basal furrow of the rostrum is a good character by which the species can be at once recognised, for this furrow is quite distinct in all the three species mentioned above. *H. tenuegranosus* differs further from *H. furvus* in its longer and more strongly curved rostrum, its longer and more slender antennæ, and finally the much smaller size of the prothorax in proportion to the elytra, which is specially noticeable in the ♀. This species has a wider range than any other in the genus.

39. H. SPECTRUM (F.).

Curculio spectrum F. Syst. El. ii. p. 537 (1801).

H. spectrum Gyl. Schh. Gen. Curc. i. p. 462 (1833); Labr. & Imh. Gen. Curc. ii. no. 33 (1848).

Long. 25–29, lat. 10½–11½ mm.

Head convex, with close shallow punctuation, and brown scaling on vertex, forehead with a faint rounded impression; anteocular furrows deep, rather converging above. *Rostrum* not incised at

base, as long as head and prothorax, strongly curved beyond middle. Upper surface with a distinct continuous central furrow (in some examples it is of nearly even width throughout, in others markedly narrower in the middle), dilated at base into a large rounded impression, finely aciculate and with sparse pale scaling; lateral sulci not meeting at base, the lower one much longer and deeper than the upper and also strongly curved upwards at base; scrobes directed to beneath base of rostrum; inferior basal furrow present. *Antennæ* with scape scarcely reaching eye; the two basal joints of funicle subequal. *Prothorax* much longer than the width at base, which is broader than apex, sides dilated about middle into a strong tuberculate spine, dorsal anterior margin slightly convex, ocular lobes distinct. Upper surface almost plane, unevenly and sparingly set with low rounded tubercles, there being usually a single much larger one about middle on each side of the central furrow, which latter contains a low carina; behind the apex is a broad and deep transverse impression almost devoid of tubercles; the apical portion is raised into a strong callus, which is smooth and strongly punctured on its anterior edge, but tuberculate behind; tubercles bare and with short depressed pale setæ, interstices with fairly dense light brown scaling. *Elytra* elongato-ovate, shoulders sloping, sides gently rounded, broadest about middle, apical processes very short but broad, pointed, and divergent in ♀, obsolete in ♂. Upper surface convex, with rows of shallow punctures separated by minute granules; interval 1 with a single regular row of small granules vanishing near apex; interval 2 with a short, apical, slightly raised row of closely-set granules; intervals 3, 5, and 7 slightly raised and with rows of closely-set granules, generally more or less duplicated; 4 and 6 plane, or at most with a few isolated granules near base; granules bare and with pale depressed setæ, interspaces fairly closely covered with very small light brown scaling variegated with lighter spots, and usually with a conspicuous broad paler band across the top of the declivity. *Legs* with sparse pale scaling, forming a denser ring near apex of femora; posterior tarsi with the joints of about the same width, 2nd and 3rd subequal in length, 1st rather longer.

Cape Colony: Algoa Bay (*Dr. H. Brauns*), Uitenhage (*Rev. J. A. O'Neil*).

Father O'Neil finds this to be an uncommon species in his neighbourhood, where it feeds on a conifer, the Bastard Yellow-wood (*Podocarpus elongata*).

Mr. Péringuey has kindly drawn my attention to the fact that Roelofs (Jorn. de Sciencias, Lisbon, 1887) has recorded this species as having been taken by Welwitsch in Angola. Welwitsch's captures are in the British Museum, and there being only two species of *Hipporrhini*, *H. ovampoensis* Pér. and *H. angolensis*, sp. nov. (nos. 75 & 76, *infra*), Roelofs' record is probably incorrect.

40. H. ABRUPTECOSTATUS Gyl.

H. abruptecostatus Gyl. Schh. Gen. Curc. i. p. 463 (1833).
H. spectrum Gyl. (*pars*) op. c. v. p. 748 (1840).

Long. 29, lat. 12 mm.

Head convex, closely but shallowly punctured and with dense fulvous scaling on vertex, forehead with an elongate central fovea; anteocular furrows deep, convergent above. *Rostrum* as long as head and prothorax, not incised dorsally at base, strongly curved beyond middle, but straight near base. Upper surface almost plane basally, broadly excavate anteriorly, with the edges obtusely raised, with even shallow punctuation and fine brown scaling throughout; upper lateral sulci very faint and not meeting at base, the lower pair much longer and deeper; scrobes directed to beneath base of rostrum; inferior basal furrow shallow. *Antennæ* with scape not reaching eye; the two basal joints of funicle subequal. *Prothorax* transverse, but the length greater than the width at base, which is a little broader than the apex, sides dilated into a strong tuberculate angular projection before middle, anterior margin rather convex and raised into a callus, ocular lobes well developed. Upper surface almost plane, with a transverse impression just behind apex, fairly closely but unevenly set with low rounded tubercles, leaving a distinct central furrow containing a low carina, and also a short curved bare space on each side; tubercles with short depressed pale setæ, they, as well as the interstices, fairly closely covered with brown scaling. *Elytra* elongato-ovate, shoulders sloping, sides distinctly rounded, broadest before middle, apical processes large, divergent, and sharply pointed in ♀, rather shorter and blunter in ♂. Upper surface convex, with regular rows of shallow punctures separated by small granules; interval 1 with a row of granules vanishing behind middle; interval 2 with only an apical row of small closely-set granules which is strongly cristate on the declivity; intervals 3, 5, and 7 with rows of agglomerated granules forming distinct costæ, all of which cease before apex; intervals 4 and 6 quite smooth; granules bare, each with a depressed pale seta; scaling small, rounded, fairly dense, dark brown variegated with small paler spots and patches. Apical margin of fourth abdominal segment in ♀ with four very distinct sharp horizontal projections; abdomen of ♂ normal. *Legs* with scattered fulvous scaling forming a dense ring round apex of femora; posterior tarsi broad, spongy beneath, the joints of about the same width, 2nd and 3rd subequal in length, 1st rather longer.

CAPE COLONY (*Sir A. Smith*).

TYPE in the Stockholm Museum.

Although Gyllenhal himself subsequently sunk this species as a synonym of *H. spectrum* F., I cannot doubt that it is a distinct species; for apart from the remarkable abdominal character in the ♀ and the compression of the elytra posteriorly, these latter are more acuminate apically and the costæ on them are much more

strongly marked, especially that on interval 2; the tubercles on the prothorax are smaller and more closely set, and its lateral projection is much blunter and not spiniform as in *spectrum*.

41. H. SPINIFER Gyl.

H. spinifer Gyl. Schönh. Gen. Curc. v. p. 748 (1840).

Long. 7½–10, lat. 3¾–5 mm.

Head convex, with grey scaling, forehead more or less distinctly wrinkled longitudinally; anteocular furrows entirely absent. *Rostrum* not incised at base, as long as head and prothorax, scarcely curved and strongly dilated apically. Upper surface densely squamose, with a deep central furrow throughout and a distinct smooth costa on either side of it; lateral sulci deep, not uniting at base, the lower one longer but narrower than the upper; scrobes shallow and lateral; inferior basal furrow absent. *Antennæ* with scape not reaching eye; the two basal joints of funicle subequal. *Prothorax* transverse, a trifle longer than the width at base, which is equal to the apex, sides dilated and produced behind middle into a sharp spine directed backwards, dorsal anterior margin slightly emarginate in middle, ocular lobes distinct. Upper surface convex, with a very deep central furrow containing no carina, but flanked on either side by a broad elevated and tuberculated costa bearing a sharply prominent tubercle behind: the space between the costa and lateral spine is smooth like the central furrow; tubercles bare, with short subdepressed setæ, the interstices clothed with fine grey setiform scaling. *Elytra* very short, broadly ovate, scarcely narrower in ♂, shoulders roundedly prominent, sides ampliated, broadest about middle, apical processes absent. Upper surface convex, with regular but rather interrupted rows of distinct granules; interval 1 with a row of small separated granules; intervals 3, 5, and 7 with narrow elevated carinæ bearing rows of depressed and elongated granules; intervals 2, 4, and 6 plane; granules shiny and with depressed pale setæ, the interstices densely clothed with fine grey setiform scaling. *Legs* elongate, with dense grey setæ forming a narrow paler ring near apex of femora; tarsi elongate, posterior pair with the joints of about even width, 2nd and 3rd subequal in length, 1st rather longer.

CAPE COLONY: Cape Town (*Prof. Lloyd Morgan*).

TYPE in Paris Museum (*teste* Schönherr).

An isolated and aberrant form, yet presenting no definite character which can be regarded as of generic value. It is the only small species possessing a spined prothorax.

I am indebted to Dr. Brauns for three examples from Drège's collection, which he obtained from Mr. J. L. Drège of Port Elizabeth.

42. H. HUMERALIS, sp. nov. (Plate I. fig. 10.)

Long. 23–28, lat. 10½–12 mm.

Head slightly convex, with scattered large punctures and pale

scaling, forehead with a small fovea near base of rostrum; anteocular furrows distinct. *Rostrum* not incised at base, about as long as head and prothorax, very thick and broadly dilated at apex, very strongly curved, being porrect in the basal half and then sharply deflected, especially in the ♂, in which the deflection is almost rectangular. Upper surface convex near base, broadly and deeply excavate apically, the sides being there raised into prominent angulated ridges; punctuation deep, except along a broad smooth central line; upper lateral sulci obsolescent, the lower ones very shallow, not reaching base; scrobes directed beneath base of rostrum; inferior basal furrow present. *Antennæ* with dense pale pubescence; scape not nearly reaching eye; the two basal joints of funicle subequal. *Prothorax* longer than its width at base, which is a little broader than apex, sides moderately rounded, broader about middle, dorsal anterior margin distinctly convex, ocular lobes very prominent. Upper surface almost plane, set with large separated conical tubercles arranged in three irregular rows on each side, central furrow large, containing a long and distinct carina; tubercles bare, smooth, each with a short dark seta, the interstices closely covered with large pale round scales. *Elytra* oblongo-ovate, shoulders sloping, sides subparallel to beyond middle in ♂, slightly rounded in ♀, broadest about middle, apical processes short, conical and divergent in both sexes. Upper surface convex, with uneven rows of shallow punctures separated by small granules; interval 1 with a row of granules vanishing behind middle; interval 2 with only an apical row of six conical tubercles, those on the declivity very large; interval 3 with a complete row of tubercles, small on the basal half, but large and conical on the declivity; intervals 4 and 6 smooth; 5 with a very large boss-like tubercle at base, followed by a row of 10 to 12 small subconical tubercles; 7 with a complete row of similar tubercles, those at extreme base and apex being rather large. Tubercles bare, each with a short dark depressed seta, the interspaces thinly clothed with large round pale scales. *Legs* closely covered with elongate white scales, except the coxæ, which are mostly fulvous, the punctuation close but shallow; posterior tarsi with joints of about the same width, 2nd and 3rd subequal in length, 1st a little longer.

NAMAQUALAND: O'okiep (*L. Péringuey*).

TYPE in the British Museum.

This very striking species was found by Mr. Péringuey in some abundance in Little Namaqualand at an altitude of about 3500 ft., and always under dead Euphorbias or Mesembryanthemums.

43. H. NESTOR Mshl. (Plate II. fig. 1.)

H. nestor Mshl. Ann. N. H. (7) x. p. 405 (1902).

Long. 20, lat. 8, apical spines 2 mm.

Head convex, with deep scattered punctures and large white scales, forehead with a short central stria; anteocular furrows faint, the lower half obsolete. *Rostrum* not incised at base, as

long as head and prothorax, gently curved. Upper surface convex in basal half and broadly excavate near apex, distinctly punctured and with a broad smooth central line; lateral sulci not meeting at base, broad and deep, separated by a narrow carina and filled with large white scales; scrobes running beneath base of rostrum; inferior basal furrow shallow. *Antennæ* with scape not nearly reaching eye; the two basal joints of funicle subequal. *Prothorax* slightly transverse, the length about equal to the width at base, which is broader than apex, sides not much rounded, broadest about middle, ocular lobes strongly developed. Upper surface convex, with distant rounded tubercles, which are flattened and arranged in more or less regular rows on disk, but smaller, more elevated and irregular laterally; central furrow very broad and containing a short faint carina; apices of tubercles bare, shiny, and with very short depressed setæ, the interstices with dense white scaling. *Elytra* oblongo-ovate, sides scarcely rounded, broadest before middle, shoulders rounded, apical processes very long and sharp. Upper surface convex, striæ with regular rows of small granules, the alternate intervals more prominent; intervals 1, 4, and 6 entirely devoid of tubercles; interval 2 with only a single very large and sharp tubercle on the summit of the declivity; interval 3 with three large, smooth, catenulate tubercles at base, then with an irregular row of small rounded tubercles to beyond middle, where they become larger and sharply conical, the largest being at the summit of the declivity, this tubercle is of the same size as, and adjoins, that on interval 2, so as to form a conspicuous transverse row of four large tubercles; interval 5 with a very large, rounded, boss-like tubercle at base, followed by two similar but much smaller ones, then five or six small granular tubercles, and finally two or three larger conical ones beyond middle; interval 7 with a complete row of small, closely-set, conical tubercles. *Legs* with dense, even, white scaling; posterior tarsi with the three basal joints of about the same width, 2nd and 3rd subequal in length, 1st longer.

Cape Colony.

Type in the British Museum.

From the other three species which possess the boss-like humeral tubercle *nestor* may be easily recognised by the very long apical spines and the solitary large conical tubercle on interval 2 of the elytra.

44. H. nodulosus (F.).

Curculio nodulosus F. Syst. Ent. p. 154 (1775); Sparrm. Act. Holm. i. 1785, p. 46, t. 2. f. 13; Hbst. Col. vi. p. 379, t. 90. f. 3 (1797); Ol. Ent. v. 83, p. 391, t. 15. f. 188 (1807).

Curculio notonchus Wiedem. Zool. Mag. ii. 1, 1823, p. 124.

H. nodulosus Gyl. Schh. Gen. Curc. i. p. 474 (1833).

Long. 12–15, lat. 5–6 mm.

Head slightly convex, densely clothed with grey scaling except a broad bare central stripe on forehead; anteocular furrows

obsolete. *Rostrum* not incised at base, about as long as head and prothorax, comparatively slender and only slightly curved. Upper surface convex in the basal two-thirds, broadly excavate near apex, densely covered with whitish scaling except on a broad smooth central carina and two narrow ones on either side; lateral sulci not meeting at base, subequal in length, the upper pair broader; scrobes directed to beneath base of rostrum; inferior basal furrow distinct. *Antennæ* with thin pale scaling; scape not reaching eye; the two basal joints of funicle subequal. *Prothorax* a little longer than its width at base, which is broader than apex, sides obtusely angulated, broadest about middle, dorsal anterior margin distinctly convex, ocular lobes strongly developed. Upper surface convex, with a broad and very deep central furrow (without any carina) flanked by a row of small closely-set rounded tubercles, with a similar incomplete row adjoining it; beyond this a broad smooth space, followed by a single regular row of small tubercles near the margin, with another similar row a little below it; the central tubercles of this latter are a little larger than the others and thus cause the lateral angulation; apices of tubercles bare, each with a depressed dark seta, interstices with dense sandy-grey scaling, that on sides of prosternum pure white. *Elytra* elongato-ovate, shoulders sloping, sides slightly rounded, broadest about middle, apical processes very long and sharp. Upper surface convex, with regular rows of shallow punctures; intervals 1, 2, 4, and 6 devoid of tubercles; 3 and 7 each with a complete row of long sharply conical tubercles, those on the basal half of the furrow much smaller than the others; interval 5 with a very large rounded boss-like tubercle at base, followed by two (sometimes three) long conical distant tubercles; tubercles bare, except on their anterior faces which are squamose, each with a single short suberect black seta, except the boss-like tubercle which has two; scaling dense, circular, uniform greyish white. *Legs* with dense white scaling, the tibiæ mottled with bare spots; posterior tarsi narrow, joints of the same width, 1st longer than 2nd and 2nd than 3rd.

Cape Colony: Cape Town.

Type in the British Museum (coll. *Banks*).

45. H. occidentalis Mshl. (Plate II. fig. 2.)

H. occidentalis Mshl. Ann. Nat. Hist. (7) x. p. 406 (1902).

Long. 15, lat. 7 mm.

Head convex, obscurely punctured and covered with large brown scales, except a short smooth line on forehead, which contains a small puncture; a narrow ring of white scales round each eye; anteocular furrows practically obsolete. *Rostrum* not incised at base, as long as head and prothorax, very little curved. Upper surface rather convex at base, but excavate towards apex, punctured and covered with brown scales except along a broad smooth central line; lateral sulci not meeting at base, filled with large white scales, upper pair very broad and deep, the lower narrow

and faint; scrobes directed beneath base of rostrum; inferior basal transverse furrow obsolete. *Antennæ* with dense pale scaling and black setæ; scape not nearly reaching eye; the two basal joints of funicle subequal. *Prothorax* as long as broad, apex narrower than base, sides slightly dilated and with a small tubercular angulation before middle, ocular lobes strongly developed. Upper surface convex, with a broad lance-shaped central furrow containing a low carina and flanked on either side by two rows of closely but irregularly placed tubercles; beyond these a smooth longitudinal space, followed by a single regular row of tubercles close to the lateral margin, and below this another similar row, of which a single tubercle is rather larger than the others and forms the lateral projection; scaling on disk brown, but greyish in central furrow and on prosternum. *Elytra* oblongo-ovate, shoulders roundedly prominent, sides very little rounded, broadest about middle, apical processes long and sharp. Upper surface convex, with regular rows of large deep punctures, the alternate intervals dissimilar; intervals 1, 2, 4, and 6 devoid of tubercles, except a single small one near the base of the latter; intervals 3 and 7 with complete rows of conical tubercles, which become more distant, larger, and sharper towards apex; interval 5 with a very large, rounded, boss-like tubercle at base, followed by six closely-set conical tubercles, and a solitary larger and sharper one about the summit of the declivity; scaling dense, dark brown, except the suture and inflexed margins, which are grey; the boss-like tubercle is entirely bare, the others only so at their apices, which occasionally bear short depressed setæ. *Legs* with dense grey scaling; posterior tarsi narrow, the joints of about equal width, 2nd longer than 3rd and 1st than 2nd.

West Africa (?).

Type in the British Museum.

46. H. fictilis Mshl. (Plate II. fig. 3.)

H. fictilis Mshl. l. c. p. 407 (1902).

Long. 14, lat. 6 mm.

Head convex, with close shallow punctures and dense brown scaling, forehead with an elongate central fovea; anteocular furrows deep in their upper half, shallow below. *Rostrum* not incised at base, as long as prothorax, slightly curved, dilated close to apex. Upper surface convex at base, shallowly excavate towards apex, finely and sparsely punctured, with a broad smooth central line; lateral sulci not wanting at base, upper pair broad and deep, the lower obsolescent; scrobes directed beneath base of rostrum; inferior basal furrow distinct. *Antennæ* with the scape short, not nearly reaching eye; the two basal joints of funicle short, subequal. *Prothorax* longer than its width at base, which is broader than the apex, sides distinctly angulated, broadest before middle, dorsal anterior margin very convex, ocular lobes strongly developed. Upper surface rather convex, with a broad and deep central furrow containing no carina and flanked by a

high narrow ridge composed of agglomerated tubercles; beyond this a broad smooth space, followed by a lateral ridge quite similar to the dorsal one; beneath this are two or three scattered tubercles, including a large compressed one which forms the angular projection; all the tubercles smooth and without setæ; scaling dense and brown, but paler in the median furrow, the prosternum greyish. *Elytra* ovate, shoulders sloping, sides moderately rounded, broadest about middle, apical processes short but sharp. Upper surface convex, with regular rows of large shallow punctures; intervals 1, 2, 4, and 6 entirely devoid of granules or tubercles; intervals 3 and 7 with complete rows of small rounded shiny tubercles, becoming rather larger and more conical towards apex; interval 5 with a similar row but ceasing abruptly behind middle; intervals 1 and 2 very narrow, so that the space between intervals 3 and 5 is about as broad as that lying between the third intervals of the two elytra; scaling dense, uniform earthy brown, the margins broadly greyish white. *Legs* with dense pale scaling; posterior tarsi with joints of about the same width, 1st longer than 2nd and 2nd than 3rd.

Cape Colony.

Type in the British Museum.

47. H. canaliculatus Mshl. (Plate II. fig. 5.)

H. canaliculatus Mshl. l. c. p. 408 (1902).

Long. 22, lat. 10 mm.

Head convex, closely but indistinctly punctured and covered with dense brown scaling, forehead with an elongate central fovea; anteocular furrows deep and distinct in their upper half, obsolete below. *Rostrum* not incised at base, as long as head and prothorax, curved beyond middle. Upper surface with the edges angular and subparallel throughout (the genæ, however, dilated at apex), plane at base, shallowly excavate towards apex, with fine close punctuation and sparse scaling throughout, except along a narrow smooth central line; upper lateral sulci shallow, not meeting at base and vanishing beyond middle, the lower pair deep and distinct; scrobes directed beneath base of rostrum; inferior basal furrow shallow. *Antennæ* with scape not reaching eye; the two basal joints of funicle subequal. *Prothorax* as long as its width at base, apex narrower, sides angulated and with a small but prominent lateral tubercle about middle, ocular lobes well developed. Upper surface not very convex, with a broad deep central furrow, containing a strong carina, and flanked on either side by a high ridge of agglomerated tubercles; beyond this is a broad smooth space, followed by a sharply defined band of small irregularly placed tubercles along the extreme edge; scaling dense, brown above and turning suddenly to white on the prosternum immediately below the lateral tubercles. *Elytra* ovate, shoulders sloping, sides moderately rounded, broadest about middle, apical processes short but sharp. Upper surface convex, with regular rows of small shiny granules in lieu of punctures:

interval 1 granulate; interval 2 with four or five isolated low tubercles; 3 and 5 with small contiguous and usually duplicated tubercles forming an obtuse carina to beyond middle, after which the tubercles become larger, separate, and sharply conical; 4 and 6 devoid of tubercles; 7 with a complete row of separated conical tubercles, becoming larger towards apex; scaling dark brown, suture grey, interval 4 wholly, and 6 partly, white, inflexed margin entirely white. *Legs* with dense pale scaling; posterior tarsi almost devoid of setæ, joints of about the same width, 2nd and 3rd subequal in length, 1st longer.

CAPE COLONY.

TYPE in the British Museum.

48. H. HORNI Mshl. (Plate II. fig. 4.)

H. horni Mshl. l. c. p. 410 (1902).

Long. 19, lat. 8 mm.

Head convex, with dense light brown scaling on vertex; forehead bare, indistinctly punctured and with a central fovea; anteocular furrows distinct. *Rostrum* not incised dorsally at base, about as long as head and prothorax, slightly curved, dilated near apex. Upper surface distinctly convex at base, shallowly excavate at apex only, indistinctly punctured and with a broad, smooth, low carina throughout; lateral sulci not meeting at base, shallow, of about equal length; scrobes directed beneath base of rostrum; inferior basal furrow shallow. *Antennæ* with scape not nearly reaching eye; the two basal joints of funicle subequal. *Prothorax* transverse, the length rather greater than the width at base, which is broader than apex, sides subangulate, broadest about middle, dorsal anterior margin convex, ocular lobes strongly developed. Upper surface slightly convex, with four fairly regular rows of small closely-set tubercles, leaving three large smooth longitudinal spaces; the central space is closely and distinctly punctured and contains no carina, whilst the others are indistinctly punctured; below the outer row is a collection of four or five tubercles, which form the lateral angulation; tubercles black, shiny and without setæ. *Elytra* ovate, shoulders sloping, sides moderately rounded, broadest about middle, apical processes long, sharp, divergent, and turning rather upwards. Upper surface convex, with regular rows of small granules, often separated by large shallow indistinct punctures; intervals 1, 2, 4, and 6 plane and smooth; interval 3 with a complete row of shiny brown tubercles; as far as the declivity these are small, rounded, irregular, and often duplicated, but on the declivity they are large and sharply conical; interval 5 with a perfectly regular and closely-set row of small rounded brown tubercles from base to about middle, where it terminates quite abruptly; interval 7 with a complete row of small subconical tubercles; tubercles bare, shiny and without setæ. *Legs* with pale scaling; posterior tarsi rather narrow, the joints of about the same width, 2nd and 3rd subequal in length, 1st much longer.

CAPE COLONY.

TYPE in the British Museum.

Allied to *H. rubifer* (F.), which, however, lacks the lateral smooth spaces on the prothorax; the tubercles on its elytra are larger and further apart, and the row on interval 5 is complete and not abruptly interrupted.

49. H. RUBIFER (F.).

Curculio rubifer F. Syst. Ent., App. p. 822 (1775); Ol. Ent. v. 83, p. 389, t. 13. f. 159 (1807).

H. condecoratus Gyll. Schönh. Gen. Curc. i. p. 464 (1833).

H. rubrospinosus Fåhr. Schönh. op. c. v. p. 750 (1840).

Long. 22–24, lat. 9½–10½ mm.

Head convex, finely and dispersely punctured, with fairly dense brown scaling, forehead with a small central fovea; anteocular furrows rather shallow. *Rostrum* not incised at base, as long as head and prothorax, slightly curved and dilated in the apical half. Upper surface squamose and more or less distinctly punctured except along the median line, subconvex in the basal half and broadly excavate towards apex; lateral sulci of about equal length, shallow and not uniting at base; scrobes deep, directed beneath base of rostrum; inferior basal furrow present. *Antennæ* with dense pale scaling; scape not reaching eye; the two basal joints of funicle subequal. *Prothorax* rather broader than long, the length equal to the width at base, apex much narrower, sides ampliated and angulated about middle, dorsal anterior margin evidently convex, ocular lobes well developed. Upper surface convex, sparsely and irregularly set with low rounded tubercles, leaving a broad deep lance-shaped central furrow containing a faint carina, and an irregular and variable patch free of tubercles on each side of the furrow; tubercles with depressed dark setæ, the interstices with dense brown scaling except in the central furrow where it is pale grey; the underparts are covered with dense whitish scaling in sharp contrast to the upper surface. *Elytra* ovate, narrower in ♂, shoulders sloping, sides rounded, broadest about middle, apical processes in both sexes sharp, conical, and divergent. Upper surface convex, with more or less regular rows of granules in lieu of punctures; interval 1 with a row of minute granules; intervals 3, 5, and 7 more raised than the others and with complete rows of small rounded tubercles which become conical towards apex; intervals 2, 4, and 6 each with a few larger and widely separated tubercles, those on 2 being most numerous and those on 6 frequently absent; apices of granules and tubercles bare, the latter often of a reddish colour and with depressed dark setæ, the interstices with dense brown scaling, the inflexed margins being white. *Legs* with uniform dense brownish scaling; posterior tarsi with the joints of the same width, the 2nd and 3rd subequal in length.

CAPE COLONY: Cape Town and Stellenbosch (*L. Péringuey*), Piquetberg, Kraaifontein [S. A. Mus.].

TYPE in the British Museum (coll. *Banks*).

Considerable confusion has occurred as to the identity of this species, in spite of the passable figure of it given by Olivier. The insect described by Gyllenhal under the name *rubifer* (Gen. Curc. i. p. 468) is not this species, but a form of the very variable *globifer* F. *H. condecoratus* Gyl., the type of which I examined at Stockholm, is a typical ♂ *rubifer*; and although I have seen no authentic examples of *rubrospinosus* Fåhr., the description leaves no doubt as to its identity with the present species. In describing the rostrum of *condecoratus* Gyllenhal says "undique granulis elevatis piliferis adspersum"; this does not agree at all with his type, which has the rostrum punctured and without a trace of elevated granules.

50. H. ECKLONI Gyl.

H. eckloni Gyl. Schh. Gen. Curc. v. p. 756 (1840).

Long. (excl. apical processes) 24–25, lat. 11–14, apical processes 4–5 mm.

Head convex, with close shallow punctuation and brown scaling, forehead with a shallow and indefinite impression; anteocular furrows distinct. *Rostrum* not incised at base, as long as head and prothorax, comparatively slender and gradually curved. Upper surface almost plane, very shallowly excavate near apex, without any carina or smooth central line, but with close punctuation and dense scaling throughout; upper lateral sulcus obsolete, the lower one deep and distinct; scrobes directed rather beneath base of rostrum, but not so markedly as in allied species; inferior basal furrow distinct but rather shallow. *Antennæ* with scape not nearly reaching eye; the two basal joints of funicle subequal. *Prothorax* as long as broad, apex much narrower than base, sides moderately rounded, broadest before middle, dorsal anterior margin convex, ocular lobes strongly developed. Upper surface almost plane, with a broad shallow transverse impression behind apex which is almost devoid of tubercles, the rest of the surface fairly closely set with low rounded tubercles, leaving a distinct central furrow, which sometimes contains traces of a low carina; tubercles bare, with depressed pale setæ, interstices densely covered with light brown scaling. *Elytra* elongato-ovate, shoulders sloping, sides rounded, broadest about middle, apical processes very long and thick but not very sharp, slightly divergent in ♂ but usually united to apex in ♀. Upper surface convex, with regular rows of small shiny granules in the very shallow sulci; all intervals even, each with a single row of low granules except 3 and 5 which have double rows; the granules shiny and with strongly depressed pale setæ, interstices with dense rounded greyish-brown scaling. *Legs* stout, densely covered with pale scaling and setæ; posterior tarsi spongy beneath, the joints subequal in length and breadth.

CAPE COLONY: Algoa Bay (*Dr. H. Brauns*), Uitenhage (*Rev. J. A. O'Neil*).

TYPE in the Stockholm Museum.

This fine species appears to be of considerable rarity, and Father O'Neil tells me that in seven years' collecting he has found only nine or ten examples, most of which were captured on the walls of his house in the early morning, and he thinks that it must be entirely nocturnal in its habits.

51. H. BOHEMANII Fåhr.

H. bohemanii Fåhr. Öfv. K. Vet.-Ak. Förh. p. 206 (1871).

Long. 18–28, lat. 8–12½ mm.

Head convex, closely and strongly punctured and with scattered brown scaling, forehead often with a shallow central stria; anteocular furrows very deep and approaching closely above. *Rostrum* not incised dorsally at base, about as long as head and prothorax, strongly curved. Upper surface with a continuous broad but shallow central furrow, with rugose punctuation and brown scaling throughout, sometimes containing a short smooth central carina near base; upper lateral sulci short and shallow, not meeting at base, the lower pair much longer and deeper; scrobes directed beneath base of rostrum; inferior basal furrow deep. *Antennæ* with scape not reaching eye; the first joint of funicle distinctly longer than second. *Prothorax* transverse, apex much narrower than base, sides strongly rounded, broadest about middle, dorsal anterior margin slightly convex, ocular lobes well developed. Upper surface almost plane, with a shallow transverse impression behind apex, closely set with low rounded tubercles, leaving a distinct central furrow containing a strong low carina; tubercles bare, each with a depressed pale seta, the interstices with dark brown scaling. *Elytra* ovate, shoulders sloping, sides moderately rounded, broadest about middle, apical processes very short and blunt in ♂, longer and sharper in ♀. Upper surface convex, with broad shallow sulci, containing rows of large separated granules; intervals all similar, each with a row of granules which are smaller and closer than those in the sulci; granules on the intervals bare, those in the sulci mostly scale-covered, all with depressed pale setæ; interspaces densely clothed with variegated grey and brown scaling, the scales small and narrow, but not setiform. *Legs* with sparse pale scaling and setæ forming a denser ring near apex of femora; posterior tarsi with joints of the same width, 2nd and 3rd subequal in length, 1st longer.

ORANGE COLONY: Bothaville (*Dr. H. Brauns*). TRANSVAAL: Lydenburg. MATABELELAND: Buluwayo (*J. P. Cregoe*). MASHONALAND: Salisbury, Umtali. PORT. E. AFRICA: Delagoa Bay (*H. Junod*).

TYPE in the Stockholm Museum.

52. H. CHIRINDENSIS Mshl. (Plate II. fig. 6.)

H. chirindensis Mshl. l. c. p. 449 (1902).

Long. 17, lat. 1 mm.

Head convex, with indistinct punctures and fairly dense brown squamæ, forehead with a distinct central stria; anteocular furrows

very deep and approaching one another closely above. *Rostrum* not incised at base, about as long as head and prothorax, distinctly curved. Upper surface with a shallow central furrow, triangularly dilated to apex and containing a faint central carina; lateral sulci deep, the upper pair convergent at base, but not meeting, the interval between the sulci carinate and rugosely punctured; scrobes directed beneath base of rostrum; inferior basal furrow shallow. *Antennæ* with scape not reaching eye; the two basal joints of funicle subequal. *Prothorax* broader than long, apex narrower than base, sides strongly dilated, broadest about middle, ocular lobes moderate. Upper surface almost plane, with a broad transverse impression just behind apex, fairly closely set with small rounded shiny tubercles, each bearing a short depressed seta; central furrow shallow, containing a very short but well-marked carina; interstices with uniform brown scaling. *Elytra* ovate, shoulders sloping, sides moderately rounded, broadest about middle, apical processes in ♀ very short, blunt, and divergent. Upper surface convex, with regular rows of foveæ separated by small granules; interval 1 with a few indistinct granules; 2, 3, 5, and 7 subcostate and with regular rows of granules, which become rather larger on the declivity, but on interval 2 ceasing abruptly at the summit; intervals 4 and 6 plane and without granules; scaling uniform earthy brown. *Legs* with sparse depressed pale setæ on femora and an ill-defined ring of light scales near apex; tibiæ with mingled light and dark setæ, the former depressed, the latter erect; posterior tarsi with the joints of about the same width, 2nd and 3rd subequal in length, 1st longer.

MASHONALAND: Mt. Chirinda, Melsetter District.

TYPE in the British Museum.

Nearly allied to the preceding species, from which it may be distinguished by the absence of granules on intervals 4 and 6 of the elytra and the long stria on the forehead.

53. H. SULCIROSTRIS Fåhr.

H. sulcirostris Fåhr. Öfv. K. Vet.-Akad. Förh. 1871, p. 207.

Long. 20–25, lat. 8–10 mm.

Head convex, more densely squamose on vertex, and with the punctures there fine and closely set, but larger and more scattered in front; forehead with a very broad and deep central impression, continuous with that on rostrum; anteocular furrows deep. *Rostrum* not incised at base, as long as head and prothorax, the upper outline straight to beyond middle, then sharply deflected, dilated from middle to apex. Upper surface with a very broad and deep central furrow throughout, edged on either side by an angulated costa which is continued on to the forehead; upper lateral sulcus obsolete, the lower one long and distinct; scrobes deep, directed beneath base of rostrum; inferior basal furrow absent. *Antennæ* squamose, scape not reaching eye; the two basal joints of funicle subequal. *Prothorax* as long as broad, apex scarcely narrower than base, sides rounded, broadest about middle,

dorsal anterior margin truncate, ocular lobes well developed. Upper surface slightly convex, unevenly set with rounded and rather distant tubercles, leaving a distinct central furrow containing a low carina and with a low tubercular callus just behind apex; tubercles bare, with depressed setæ, the interstices with thin brown scaling. *Elytra* ovate, narrower in ♂, shoulders sloping, sides rounded, broadest about middle, apical processes sharply conical and divergent in both sexes. Upper surface convex, with fairly regular rows of granules in lieu of punctures; interval 1 with a row of distant granules becoming much smaller towards apex; interval 2 with a short subcristate row of small conical tubercles on the declivity, and occasionally one or two isolated tubercles on the basal part; intervals 3, 5, and 7 with complete rows of small conical tubercles; 4 and 6 usually devoid of tubercles, but sometimes with an abbreviated or interrupted row; tubercles bare, sometimes with very short depressed setæ, the interstices with brown scaling. *Legs* clothed with thin white depressed setæ; posterior tarsi broad, the 3rd joint scarcely broader than the others, 2nd and 3rd subequal in length.

NATAL: Drakensberg Mts., 6000 ft. (*J. M. Hutchinson*). TRANSVAAL: Lydenburg.

TYPE in the Stockholm Museum.

This insect is most nearly allied to *recurvus* F. and *albolineatus* Fåhr., all three being characterised by the depth and continuity of the rostral furrow. *H. sulcirostris* differs from the others in lacking the basal dilatation of this furrow; the impression on the forehead is much broader and deeper; the thoracic tubercles are much fewer and more distant; the discal tubercles on the elytra are more conical and further apart, and the apical processes are not turned upwards.

The type specimens, as well as all others which I have seen from the Transvaal, are of a brown colour owing to the dense scaling; but six specimens taken by Mr. Hutchinson and myself, on the foot-hills of the Drakensberg, have the scales so minute and widely scattered as to make them appear quite bare and black to the unaided eye. These insects we found on the branches of a *Protea*, and it was by no means easy to detect them upon the black bark, with which their rough elytra assimilated so well. Possibly this is a local mountain form which has adapted itself to special conditions.

54. H. RECURVUS (F.).

Curculio recurvus F. Syst. El. ii. p. 535 (1801).
H. sparrmani Gyl. Schh. Gen. Curc. i. p. 471 (1833).
H. recurvus Fåhr. Schh. op. c. v. p. 753 (1840).

Long. 20–23, lat. 8½–9½ mm.

Head convex, with deep scattered punctures and sparse white scaling, forehead with a short central stria; anteocular furrows rather shallow and scarcely visible from above. *Rostrum* not incised transversely at base, about as long as head and prothorax,

distinctly curved and dilated towards apex. Upper surface strongly punctured, with a deep continuous and impunctate central furrow, more or less distinctly dilated into a broad impression near base; upper lateral sulci obsolete, lower ones distinct but shallow; scrobes directed to beneath base of rostrum; inferior basal furrow absent. *Antennæ* with scattered white setæ; scape just reaching eye; the two basal joints of funicle subequal. *Prothorax* transverse, apex rather narrower than base, sides distinctly rounded, broadest about middle, dorsal anterior margin truncate, ocular lobes not much developed. Upper surface slightly convex, set with small elevated and separated tubercles, leaving a central furrow containing a distinct carina; tubercles bare, each with a short depressed dark seta, the interstices with dense large round white scales. *Elytra* ovate, narrower in ♂, shoulders sloping, sides rounded, broadest about middle, apical processes long, sharply conical, divergent and turned upward. Upper surface convex, with regular rows of shallow punctures separated by small granules; interval 1 with a row of small depressed elongate tubercles, ceasing behind middle; interval 2 with only a short apical row of small conical and widely separated tubercles; intervals 4 and 6 quite smooth; 3, 5, and 7 with complete rows of small, subconical, closely-set, more or less depressed and elongate tubercles, which become more conical, more distant, and rather larger towards apex; tubercles bare, each with a short depressed dark seta, the interspaces with large round white scales, which are rather sparse on disk and much denser laterally; where the scales have been removed a number of small white dots may be seen. *Legs* with sparse white scaling; posterior tarsi broad, with the 2nd joint a little narrower than the other two, 2nd and 3rd subequal in length, 1st somewhat longer.

Cape Colony: Cape Town and the Table Mt. range.

Mr. Péringuey tells me that he has taken this species only sparingly on heath-flowers on Table Mt.

55. H. albolineatus Fåhr.

H. albolineatus Fåhr. Schönh. Gen. Curc. v. p. 754 (1840).

Long. 17–22, lat. 6½–9 mm.

Head convex, with sparse shallow punctuation, forehead with a broad central impression which is a continuation of the rostral furrow; anteocular furrows deep. *Rostrum* not incised transversely at base, as long as head and prothorax, curved and dilated towards apex. Upper surface with large shallow punctures and with a deep central furrow throughout which is broadened into a distinct rounded impression at the base; upper lateral sulcus obsolete, the lower one present but shallow; scrobes directed beneath base of rostrum; inferior basal furrow absent. *Antennæ* with scape just reaching eye; the two basal joints of funicle subequal. *Prothorax* almost as long as broad, apex scarcely narrower than base, sides slightly rounded, broadest about middle, dorsal anterior margin truncate, ocular lobes strongly developed. Upper

surface almost plane, moderately closely set with low rounded tubercles, leaving a shallow central furrow containing an abbreviated carina; tubercles bare, each with a setigerous puncture, the interstices with three dorsal and one lateral line of white scales. *Elytra* elongato-ovate, much narrower in ♂, shoulders sloping, sides slightly rounded, broadest about middle, apical processes in both sexes sharply conical and turned upwards. Upper surface convex, with fairly regular rows of indistinct punctures separated by granules; interval 1 with a row of small distant depressed tubercles, diminishing posteriorly; intervals 2, 3, 5, and 7 with complete rows of tubercles, those on disk and near base somewhat depressed and elongated, but becoming sharply conical towards the sides and apex; intervals 4 and 6 plane, or at most with one or two isolated tubercles; tubercles bare, usually with short depressed setæ, intervals 4 and 6 and the lateral margin with stripes of white scaling. *Legs* finely punctured and with sparse setæ; the posterior tarsi with the 3rd joint a little broader than the others, 2nd and 3rd subequal in length, 1st rather longer.

Cape Colony; Knysna, Constantia.

The type of this species is missing, and not one of the 10 or 12 examples which I have examined exhibits the dorsal white stripes mentioned by Fåhræus, but these have probably been abraded or discoloured. The species is very closely allied to *recurvus* F., from which it differs, apart from the colouring, in having larger and more prominent granules between the punctures on the elytra, and especially in the much greater development of the ocular lobes.

56. H. gyllenhali Gyl.

H. gyllenhali Gyl. Schh. Gen. Curc. v. p. 753 (1840).

Long. 22, lat. 8½ mm.

Head convex, with shallow scattered punctuation, forehead with a faint central stria; anteocular furrows deep. *Rostrum* not incised at base but evenly continuous with head, as long as head and prothorax, almost porrect near base and deflected beyond middle. Upper surface shallowly excavate near apex, plane and slightly convex in the basal half, where there is a short central stria continuous with that on forehead, punctuation strong and deep but absent from the central line; upper lateral sulcus obsolete, lower one well developed; scrobes curved and directed beneath base of rostrum; inferior basal furrow absent. *Antennæ* with scape barely reaching eye; 2nd joint of funicle a little longer than 1st in ♀. *Prothorax* somewhat broader than long, apex scarcely narrower than base, sides moderately rounded, broadest about middle, dorsal anterior margin truncate, ocular lobes prominent. Upper surface almost plane, set with rather distant subconical tubercles, which are sharper laterally and leave a distinct central furrow containing a short low carina; tubercles bare, each with a depressed pale seta, interstices with whitish scaling. *Elytra* elongato-ovate, shoulders sloping, sides moderately rounded, broadest about middle, apical processes in ♀ long sharp divari-

cating and directed upwards. Upper surface convex with regular rows of small granules separated by shallow punctures; interval 1 with a complete row of depressed granules; intervals 2, 4, and 6 quite plane, or at most with one or two isolated tubercles; intervals 3, 5, and 7 with complete rows of small tubercles, which are depressed and closely set near base, but larger, more conical, and more distant towards apex; tubercles with short depressed yellow setæ; scaling thin, light brown, variegated with white, especially towards sides. *Legs* without scales, but with sparse white setæ; posterior tarsi with the three joints nearly equal in length and breadth.

Cape Colony: Table Mt. Range (*L. Péringuey*).

Very closely allied to *recurvus* F., from which it differs in having a fine stria on the rostrum instead of a deep central furrow with a basal impression; the rostrum is also more strongly declivous near the apex; the eyes are less prominent; the ocular lobes on the thorax are better developed; and the scales on the elytra are distinctly smaller.

57. H. nivosus (Sparrm.).

Curculio nivosus Sparrm. Act. Holm. i. 1785, p. 45, t. 2. f. 11.

Curculio nodulosus Hbst. (nec F.) Col. vi. p. 300, t. 83. f. 8 (1797).

H. recurvus Gyl. (nec F.) Schh. Gen. Curc. i. p. 467 (1833).

H. nivosus Gyl. op. c. p. 470 (1833); Fåhr. Schh. op. c. v. p. 752 (1840).

Long. 25, lat. 10 mm.

Head convex, with scattered shallow punctuation and fulvous scaling forming a band across vertex, a ring round each eye, and a central stripe on forehead: a deep fovea at base of rostrum; anteocular furrows distinct, rather convergent above. *Rostrum* not incised dorsally at base, as long as head and prothorax, in profile the upper outline is straight from base to far beyond middle and then sharply deflected. Upper surface obscurely punctured, almost plane in basal half, shallowly excavate and dilated apically, its edges there carinate and sharply angulated above the insertion of antennæ; upper lateral sulci absent, the lower ones very faint and filled with yellowish scaling; scrobes directed beneath base of rostrum; inferior basal furrow shallow. *Antennæ* with dense yellowish scaling; scape scarcely reaching eye; the two basal joints of funicle subequal. *Prothorax* scarcely broader than long, apex much narrower than base, sides strongly rounded, broadest about middle, dorsal anterior margin convex, ocular lobes moderate. Upper surface almost plane, fairly closely set with rather large depressed tubercles, leaving a central furrow containing a very short low carina and a narrow smooth line on either side; tubercles with short depressed black setæ, interstices bare, except the three smooth lines and the sides of prosternum, which are clothed with rounded creamy-yellow or white scales. *Elytra* elongato-ovate, shoulders sloping, sides slightly rounded,

broadest about middle, apical processes long, sharp and divergent. Upper surface convex, with regular rows of small granules; interval 1 with a row of small low tubercles, decreasing greatly in size towards apex; intervals 2, 3, 5, and 7 with complete rows of large, depressed, elongate and separated tubercles, which become bluntly conical near apex, those on the declivity of interval 2 being larger than the rest; intervals 4 and 6 smooth, or at most with a few isolated tubercles near base; tubercles bare, with short black depressed setæ, interstices (except on intervals 2 and 3) clothed with dense or cream-coloured scaling. *Legs* with dense yellowish scaling variegated with bare black spots; posterior tarsi with joints of about the same width, 2nd and 3rd subequal in length, 1st rather longer.

Cape Colony; Damaraland.

58. H. maculatus Mshl. (Plate II. fig. 9.)

H. maculatus Mshl. l. c. p. 412 (1902).

Long. 26, lat. 11 mm.

Head convex, closely shagreened on vertex, punctured in front, with a broad band of elongate yellow scaling across forehead and running down in front of each eye; forehead with a deep fovea near base of rostrum; anteocular furrows deep and complete, converging somewhat dorsally. *Rostrum* not incised at base, as long as head and prothorax, in profile the upper line is straight from base to near the insertion of the antennæ, then sharply deflected. Upper surface broadly but very shallowly excavate throughout, with its edges strongly carinate from base to insertion of antennæ, with punctures and yellow scaling at the sides, and a broad smooth central line throughout; upper lateral sulci obsolete, the lower ones faint, filled with yellow scales, and quite hidden from above by the lateral carina; scrobes directed beneath base of rostrum; inferior transverse basal furrow absent. *Antennæ* with dense yellow scaling; scape not quite reaching eye; the two basal joints of funicle subequal. *Prothorax* transverse, length equal to width at base, apex narrower, sides strongly rounded, broadest about middle, ocular lobes moderately developed. Upper surface almost plane, sparsely covered with large flattened tubercles, leaving a central furrow containing a very short carina and a lateral smooth line on either side; prosternum and the three dorsal lines covered with yellow scaling, the rest bare. *Elytra* ovate, shoulders sloping, sides moderately rounded, broadest about middle, apical processes in female long and sharp. Upper surface convex, the striæ with more or less regular rows of large granules, the intervals unequally tuberculate; interval 1 with elongate depressed tubercles, becoming smaller behind and vanishing before apex; intervals 2, 3, and 5 with closely-set, elongate, depressed tubercles to beyond middle, after which they become sharply conical to apex, those on interval 2 being most prominent; intervals 4, 6, and 7 with smaller separated tubercles, depressed near base and conical towards apex; tubercles and granules quite bare and

without setæ, the interspaces with small patches of dense yellow scales, forming more or less regular rows of spots along the intervals. *Legs* with dense yellow scaling variegated with numerous bare black spots; posterior tarsi broad, the joints subequal in length and breadth.

NATAL (*? teste* Jekel).

TYPE in the British Museum.

I have seen only the unique type of this species. It is most nearly allied to *nivosus* Sparrm., but also bears some resemblance to *insignis* Fåhr. From both these species it may be distinguished by the absence of the inferior basal furrow on the rostrum, and in having the dorsal edges of the latter sharply carinate right up to the base, but they are not raised into a sharp angle in front as is the case with *nivosus*. *H. maculatus* agrees with *nivosus* and differs from *insignis* in having the tubercles on interval 2 more prominent than those on 3.

59. H. GLOBIFER (F.).

Curculio globifer F. Syst. Ent. App. p. 823 (1775); Ol. Ent. v. 83, p. 388, t. 11. f. 135 (1807).

H. tuberifer Gyl. Schh. Gen. Curc. i. p. 466 (1833).

H. misumenus Gyl. l. c.

H. rubifer Gyl. (nec F.) l. c. p. 468 (1833).

H. tuberifer Fåhr. Schh. Gen. Curc. v. p. 751 (1840).

H. misumenus Fåhr. l. c.

Long. 21-29, lat. 9-12½ mm.

Head convex, with close shallow punctuation and fine fulvous scaling, forehead with a short stria; anteocular furrows deep. *Rostrum* not incised at base, about as long as head and prothorax, stout, curved and dilated apically. Upper surface plane or slightly convex at base, shallowly excavate towards apex, with a broad smooth central line, the sides being distinctly punctured and scattered with fulvous setæ; lateral sulci not meeting at base, the upper pair faint, the lower long and deep; scrobes deep, directed beneath rostrum; inferior basal furrow distinct. *Antennæ* with scape not nearly reaching eye; the two basal joints of funicle subequal. *Prothorax* about as long as broad, apex narrower than base, sides rounded, broadest about middle, dorsal anterior margin convex, ocular lobes well developed. Upper surface convex, moderately closely set with large rounded tubercles, leaving a distinct central furrow containing a faint carina, and also a narrow smooth lateral line on each side; tubercles bare, with depressed brown setæ, the interstices with fulvous scaling, the central furrow and lateral lines being paler and sometimes white. *Elytra* oblongo-ovate, slightly broader in ♀, shoulders sloping, sides rounded, broadest about middle, apical processes in both sexes stout, sharply conical and turned slightly upwards. Upper surface convex, with regular rows of small granules instead of punctures; interval 1 granulate; 2 with a row of widely-separated depressed tubercles; intervals 3, 5, and 7 subcostate, with row

of small, closely-set, and often duplicated tubercles, which become rather larger and conical towards apex; 4 and 6 devoid of tubercles or with a few isolated ones; tubercles bare, with depressed pale setæ, the interspaces with dense brown scaling, often variegated with white spots. *Legs* densely clothed with brown setiform scaling, sometimes with a paler ring near apex of femora; posterior tarsi with the joints of about the same width, 2nd and 3rd subequal in length, 1st longer.

Cape Colony: Cape Town, Stellenbosch (*L. Péringuey*).

Type in the British Museum (coll. *Banks*).

As mentioned above, Schönherr misinterpreted this species as being the *rubifer* of Fabricius, apparently disregarding Olivier's identification. The figure given by the latter is that of a large ♀ which is now in the Chevrolat Collection at Stockholm, and which closely resembles the type. This species shows considerable variation in size, colouring, and the tuberculation of the elytra, some of the extreme forms showing a noticeable approach towards *spiculosus* Gyl. I consider *misumenus* Gyl., of which I have examined the type, to be no more than a variety of the present species, an opinion towards which Fåhræus evidently inclined.

Mr. Péringuey states that this insect is common on the flats near Cape Town, but it seems nevertheless to be scarce in collections.

60. †H. spiculosus Gyl.

H. spiculosus Gyl. Schh. Gen. Curc. i. p. 469 (1833); Fåhr. op. c. v. p. 751 (1840).

Curculio glandifer F. Ent. Syst. i. 2, p. 483 (1792)?

Curculio globifer Hbst. Col. vi. p. 299, t. 83. f. 6 (1797).

Long. 2¼, lat. 9½ mm.

Head convex, with shallow punctuation and sparse scaling, forehead with a faint stria; anteocular furrows deep. *Rostrum* not incised at base, as long as head and prothorax, stout, curved and dilated apically. Upper surface plane at base, shallowly excavate towards apex, with a broad smooth central line, the sides being distinctly punctured and scattered with fulvous setæ; lateral sulci not meeting at base, the upper pair obsolescent, the lower long and deep; scrobes deep, directed beneath base of rostrum; inferior basal furrow distinct. *Antennæ* with scape not reaching eye; the two basal joints of funicle subequal. *Prothorax* slightly transverse, apex narrower than base, sides rounded, broadest about middle, dorsal anterior margin convex, ocular lobes well developed. Upper surface convex, moderately closely set with large rounded tubercles, leaving a distinct central furrow containing a faint carina and also a narrow smooth lateral line on each side; tubercles bare, with depressed dark setæ, the interstices with fulvous scaling, the central furrow and lateral lines being white. *Elytra* oblongo-ovate, rather broader in ♀, shoulders sloping, sides rounded, broadest about middle, apical processes in both sexes stout, sharply conical and turned slightly upwards.

Upper surface convex, with regular rows of very small granules; interval 1 with a row of small closely-set tubercles disappearing before apex; interval 2 with a row of distant low elongate tubercles, but those near apex very long and sharp; intervals 3 and 5 with single rows of smaller, rounded, and more closely-set tubercles, becoming very long, sharp, and curved towards apex; 4 and 6 devoid of tubercles, or with only a few isolated ones; 7 with a complete row of sharply conical tubercles, becoming longer and more curved posteriorly; tubercles bare, often of a reddish-brown colour, with depressed dark setæ, the interspaces with fulvous scaling, the suture and inflexed margins being white and the disk more or less variegated with white patches. *Legs* with scattered narrow white scales; posterior tarsi with the joints of the same width, 2nd and 3rd subequal in length, 1st longer.

Cape Colony: Table Mt. (*L. Péringuey*), Koeberg.

Types in the Stockholm Museum.

This insect holds an intermediate position between *globifer* F. and *insignis* Fåhr., approaching very closely to some of the Eastern examples of the latter. Indeed it seems doubtful whether the examination of a long series would not render it necessary to regard all three as forms of one very variable species.

61. †H. insignis Fåhr.

H. insignis Fåhr. Öfv. K. Vet.-Ak. Förh. p. 206 (1871).

H. zeyheri Boh. (*inedit.*).

Long. 25–32, lat. 9½–12 mm.

Head convex, with shallow punctuation and scattered white or fulvous scaling, forehead with a variable central stria; anteocular furrows deep. *Rostrum* not incised at base, as long as head and prothorax, thick, curved and dilated towards apex. Upper surface plane or slightly convex at base, shallowly excavate near apex, with a broad smooth central line, which is sometimes faintly carinate, the sides being distinctly punctured and scattered with dark setæ; lateral sulci not uniting at base, the upper pair obsolete, the lower pair long and deep; scrobes deep, directed beneath base of rostrum; inferior basal furrow distinct. *Antennæ* with scape not reaching eye; the two basal joints of funicle subequal. *Prothorax* slightly transverse, apex narrower than base, sides rounded, broadest about middle, dorsal anterior margin convex, ocular lobes well developed. Upper surface convex, moderately closely set with large rounded and rather elevated tubercles, leaving a distinct central furrow containing a very faint carina and a narrow curved smooth lateral line on each side; tubercles bare, with depressed dark setæ, the interstices with white or fulvous scaling, in the latter case the central and lateral lines white. *Elytra* elongato-ovate, ♀ slightly broader, shoulders sloping, sides not much rounded, broadest about middle, apical processes in both sexes stout, sharply conical and turned slightly upwards. Upper surface convex, with irregular, and often confused, rows of large granules; interval 1 with a row of small

tubercles disappearing near apex; interval 2 with small rounded distant tubercles, which are conical posteriorly; 3 and 5 with more closely-set, but not smaller, tubercles, also becoming sharply conical towards apex; 4 and 6 sometimes without tubercles, but usually with several isolated ones; 7 with a complete row of conical tubercles of almost the same size throughout; tubercles bare, with depressed dark setæ, the interspaces with fulvous scaling, largely variegated with white. *Legs* with scattered large round white scales; posterior tarsi with the joints of the same width, 2nd and 3rd subequal in length, 1st rather longer.

NAMAQUALAND: O'okiep (*L. Péringuey*). CAPE COLONY: Willowmore (*Dr. H. Brauns*), Worcester, Fraserburg, and Swellendam.

TYPE in the Stockholm Museum.

My only example from Willowmore has the scape and also the joints of the funicle rather longer than in the Namaqualand specimens, and the carination of the rostrum is slightly more pronounced. The other Cape Colony examples are characterised by their less elongate form, duller colouring, and the larger tubercles on the elytra.

Mr. Péringuey states that this species is common in Little Namaqualand, both on the coast sand-dunes and further inland at an elevation of 3000 ft.

62. H. VAFER Fåhr.

H. vafer Fåhr. Schh. Gen. Curc. v. p. 755 (1840).

Long. 19–26, lat. 8½–10½ mm.

Head convex, with distinct scattered punctures and sparse scaling, forehead not flattened and with a faint central stria; anteocular furrows deep, rather convergent dorsally. *Rostrum* not incised at base, as long as head and prothorax, slightly curved. Upper surface rather convex at base, shallowly excavate near apex, strongly and closely punctured except for a low smooth central carina; lateral sulci strong, the upper pair uniting at base; scrobes directed to beneath base of rostrum; inferior basal furrow almost obsolete. *Antennæ* with scape almost reaching eye; the two basal joints of funicle subequal. *Prothorax* a little broader than long, apex narrower than base, sides rounded, broadest about middle, apical margin convex, ocular lobes well developed. Upper surface convex, fairly closely set with low rounded separated tubercles, leaving a narrow central furrow containing a fine carina; tubercles bare, without setæ, interstices with pale brown scaling. *Elytra* ovate, shoulders sloping, sides rounded, broadest about middle, apical processes short and thick but sharply pointed and directed upwards. Upper surface convex, with regular rows of distinct granules; interval 1 granulate; 2, 3, 5, and 7 with complete rows of small tubercles, low and rounded on disk, but conical towards sides and apex, the tubercles on interval 2 set much further apart than the others; intervals 4 and 6 without tubercles or only a few low isolated ones; tubercles bare, usually without setæ, interstices with scattered brownish scaling. *Legs*

with sparse pale setæ; posterior tarsi with the joints of same width, 2nd and 3rd subequal in length, 1st rather longer.

CAPE COLONY: Table Mt.

TYPE in the Stockholm Museum.

63. †H. KNYSNA, sp. nov.

Long. 28, lat. 11 mm.

Head convex, closely shagreened, and with brown scaling on vertex; forehead with a shallow central stria, dispersely punctured and with scattered white scales; anteocular furrows distinct, not convergent above. *Rostrum* not incised at base, as long as head and prothorax, strongly curved and dilated from behind middle to apex. Upper surface dispersely punctured laterally, and with scattered isolated white scales, plane or slightly convex at base, deeply and broadly excavate anteriorly, the edges there being sharply carinate; lateral sulci shallow, the upper pair much shorter than the lower and uniting at base; scrobes deep, directed beneath base of rostrum; inferior basal furrow absent. *Antennæ* with dense black and white setæ; scape scarcely reaching eye; the two basal joints of funicle subequal. *Prothorax* almost as long as broad, apex rather narrower than base, sides slightly rounded, broadest rather behind middle, dorsal anterior margin convex, but emarginate in the middle, ocular lobes strongly developed. Upper surface convex, with a broad but very shallow and ill-defined central furrow containing a low carina and with a row of large depressed tubercles on each side of it; beyond this a broad smooth space, followed by two or three irregular lateral rows of rounded and elevated tubercles; tubercles bare, shiny, each with a depressed dark seta, the interstices with dense large round white scaling. *Elytra* elongato-ovate, shoulders sloping, sides not much rounded, broadest about middle, apical processes in ♀ stout, sharply conical and turned slightly upwards. Upper surface convex, with fairly regular rows of small granules; interval 1 with a row of tubercles, becoming much smaller behind middle and vanishing before apex; intervals 2 and 3 with complete rows of large tubercles, which are elongate and depressed on disk, but sharply conical and more distant behind; intervals 5 and 7 with complete rows of smaller, more closely-set, conical tubercles; 4 and 6 with incomplete or interrupted rows; tubercles bare, shiny, each with a depressed dark seta, the interspaces with scattered large white scales. *Legs* with sparse white scaling and black setæ; posterior tarsi broad, the joints of the same width, 2nd and 3rd subequal in length 1st rather longer.

CAPE COLONY: Knysna [S. A. Mus.].

TYPE in the South African Museum.

Very similar in general appearance to some examples of *H. insignis* Fåhr., but readily distinguishable owing to its very different rostrum, which is much shorter and more strongly curved, its dorsal margins sharply carinate and the upper lateral sulci uniting at the base.

64. H. SEXVITTATUS (F.).

Curculio sexvittatus F. Ent. Syst. i. 2, p. 478 (1792).
Curculio nycthemerus Sparrm. Act. Holm. i. 1785, p. 46, t. 2. f. 12.
Curculio sexvittatus Hbst. Col. vi. p. 314, t. 66. f. 1 & t. 84. f. 12 (1787); Ol. Ent. v. 83, p. 386, t. 12. f. 149 (1807).
H. sexvittatus Gyl. Schh. Gen. Curc. i. p. 472 (1833).

Long. 21, lat. 7½ mm.

Head convex, with close but shallow punctuation and thin scaling, which forms a transverse band on vertex and a line running from it above each eye, forehead with a small central impression; eyes very prominent; anteocular furrows deep. *Rostrum* without a basal transverse incision, as long as head and prothorax, moderately curved, strongly dilated at apex, the genæ being angulate externally. Upper surface plane in its median half, with a deep rounded impression at base and another near apex, finely but distinctly punctured except along the median line; upper lateral sulci almost obsolete, lower pair short but deep; scrobes directed beneath base of rostrum; inferior basal furrow absent. *Antennæ* with the scape not reaching eye; the two basal joints of the funicle subequal. *Prothorax* as long as broad, apex narrower than base, sides very little rounded, broadest about middle, anterior margin slightly convex, ocular lobes feebly developed. Upper surface rather convex, with four broad lines of closely-set depressed tubercles, leaving a central furrow containing a low carina and a broad smooth space on either side; these two spaces and a broad stripe on the side of prosternum densely clothed with round white scales, the rest of the surface bare. *Elytra* oblongo-ovate, shoulders sloping, sides subparallel to beyond middle, apical processes short and rather blunt. Upper surface convex, with regular rows of small shallow punctures; interval 1 subcostate to beyond middle only; interval 2 with only a short apical subcristate row of small agglomerated tubercles; intervals 3, 5, and 7 with subcatenulate rows of small, often duplicated, tubercles, that on interval 3 ceasing behind middle; 4 and 6 entirely plane; colour black, with a broad stripe of dense round white scales extending from the outer half of interval 3 to the inner half of interval 7, broken only by the bare tubercles on interval 5, on the declivity this stripe extends further inwards to interval 2; on the inflexed margin is another broad white stripe, which does not quite reach the base and unites broadly with the inner stripe at apex. *Legs* with sparse white scaling forming a denser patch near apex of femora; posterior tarsi broad, the 3rd joint rather broader than the others, 2nd and 3rd subequal in length, 1st longer.

CAPE COLONY: Table Mt. Range.

65. H. TRANSVAALENSIS Pér.

H. transvaalensis Pér. Trans. S. Afr. Phil. Soc. (1885) p. 142.

Long. 27–30, lat. 11–12 mm.

Head with vertex convex, closely but shallowly punctured an

with a band of dense brown scaling; forehead bare, impunctate, broadly and deeply impressed; anteocular furrows deep, but invisible from above. *Rostrum* continuous in the same plane as forehead, as long as head and prothorax; in profile, the upper edge is straight to beyond middle and then sharply declivous. Upper surface with a broad but shallow central furrow throughout (almost obliterated about middle), faintly punctured and with short setiform scaling; upper lateral sulci faint, but evidently uniting at base, lower pair rather shorter but much deeper; scrobes directed beneath base of rostrum; inferior basal furrow absent. *Antennæ* with scape not nearly reaching eye; the two basal joints of funicle subequal. *Prothorax* as long as broad, apex a little narrower than base, sides rounded, broadest rather behind middle, apical margin truncate, ocular lobes well developed. Upper surface almost plane, with a broad discal, and narrower lateral, row of low rounded tubercles on each side of central furrow, which latter contains a distinct carina; tubercles bare, each with a very short seta; among the tubercles the scaling is brown, but greyish white in the smooth spaces. *Elytra* ovate, shoulders sloping, sides gently rounded, broadest about middle, apical processes in ♀ long, thick, and subcontiguous. Upper surface convex, with regular rows of very small punctures; intervals 1, 4, and 6 devoid of tubercles; 3, 5, and 7 with complete rows of very small, closely placed tubercles, sometimes duplicated and subcatenulate towards base; interval 2 with only a short subcristate row of similar tubercles on the declivity; intervals 1 to 3 and the upper part of inflexed margin with thin brown scaling; intervals 4 and 6 and the edge of inflexed margin with broad stripes of dense greyish-white scaling; the brown scales distinctly narrower than the white. *Legs* with sparse pale setæ forming a denser ring near apex of femora; posterior tarsi with the joints of about the same width, 2nd and 3rd subequal in length, 1st rather longer.

Transvaal: Lydenburg (*Zutrzenka*, coll. *Distant*).

Type in South-African Museum.

An apparently rare species, representing in the Transvaal the Western *sexvittatus* F.; but the latter is a much narrower and more parallel-sided insect, and its very prominent eyes, with the correlated feeble development of the ocular lobes, constitute a very distinctive character.

66. H. delectans (Hbst.).

Curculio delectans Hbst. Col. vii. p. 47, t. 98. f. 5 (1797).
H. delectans Gyl. Schönh. Gen. Curc. v. p. 761 (1840).

Long. 17–22, lat. 7–9 mm.

Head very finely and sparsely punctured, vertex convex, forehead slightly flattened, but variable, being strongly retuse in some examples, with a short central stria; anteocular furrows deep, converging dorsally. *Rostrum* not cut off from head at base, as long as head and prothorax, thick, curved and strongly

dilated to apex. Upper surface elevated (more markedly so in some specimens), almost plane, finely but distinctly punctured, and with a narrow deep central furrow, vanishing anteriorly; lateral sulci distinct, both pairs uniting at base, the lower especially forming a very deep oblique impression just before base; scrobes very deep, directed beneath base of rostrum; inferior basal furrow absent. *Antennæ* thinly squamose, scape just reaching eye; the two basal joints of funicle subequal. *Prothorax* transverse, apex narrower than base, sides slightly rounded, broadest about middle, dorsal anterior margin truncate, ocular lobes very feeble. Upper surface slightly convex, closely set with elevated tubercles, leaving a central furrow sometimes containing a faint carina; tubercles bare, with depressed pale setæ, the interstices with dense brown scaling. *Elytra* ovate, slightly narrower in ♂, shoulders prominent, almost rectangular, sides slightly rounded, broadest about middle, apical processes short and sharply conical in ♀, much reduced in ♂. Upper surface convex, with rows of small shallow ocellated punctures; intervals 1, 3, 5, and 7 strongly costate and with catenulated rows of depressed granules, which are more elevated and separated near apex; intervals 2, 4, and 6 quite smooth and devoid of granules; granules bare and with depressed pale setæ, the interspaces with uniform dense brown scaling. *Legs* with very sparse pale scaling; posterior tarsi broad, the 3rd joint rather broader than the others. 2nd and 3rd subequal in length, 1st longer.

Cape Colony: Algoa Bay (*Dr. H. Brauns*).

A very distinct and yet a variable species. In the British Museum is an example bearing the name *cylindrifer* (Jekel, MS.) which represents a very extreme form: the forehead is very strongly retuse; the tubercles of the prothorax are much fewer, cylindrical and spiniform, those on elytra are all separate and distinctly conical; and, finally, the elytra are markedly shorter than in the typical form and subquadrate. With the exception of the last, all these characters merge gradually into those of the typical form; and the shortness of the elytra is probably only an individual variation. Jekel's specimen is labelled "Natal," but the locality is highly doubtful.

67. H. caudatus Fåhr.

H. caudatus Fåhr. Öfv. K. Vet. Ak. Förh. p. 209 (1871).

Long. 15, lat. 6½ mm.

Head convex, obscurely punctured and with fine brown scaling, forehead without fovea or carina; anteocular furrows distinct, but invisible from above. *Rostrum* not incised at base, as long as head and prothorax, strongly curved and dilated apically. Upper surface with a broad complete central furrow and with thin setiform scaling throughout; lateral sulci not meeting at base, the upper pair rather indistinct, the lower longer and deeper; scrobes directed to beneath base of rostrum; inferior basal furrow absent. *Antennæ* with fine fulvous setæ; scape not nearly reaching

eye; the two basal joints of funicle subequal. *Prothorax* rather transverse, the length greater than the width at base, which is broader than apex, sides strongly dilated, subangulated, broadest rather before middle, dorsal anterior margin slightly convex, ocular lobes strongly developed. Upper surface almost plane, set with elevated rounded tubercles arranged in six rather irregular rows and leaving a deep central furrow containing a strong carina; tubercles each with a dark depressed seta, and thinly clothed, as well as the interstices, with brown setiform scaling; below the lateral row of tubercles is a broad stripe of large round whitish scales. *Elytra* ovate, shoulders sloping, sides gently rounded, broadest rather before middle, apical processes long, blunt and approximated. Upper surface convex, with regular rows of shallow punctures separated by granules; interval 1 with a row of small tubercles disappearing behind middle; interval 2 with only a very short subcristate row of small conical tubercles on the declivity; intervals 3, 5, and 7 each with a row of small conical tubercles, more or less interrupted near base, that on 3 ceasing abruptly behind middle; 4 and 6 plane; tubercles scale-covered and each with a depressed dark seta; scaling dark brown, each elytron with a large subquadrate paler patch at the shoulder and another subtriangular one on the declivity. *Legs* with sparse fulvous setiform scaling and a ring of broad whitish scales near apex of femora; posterior tarsi with joints of equal width, 1st longer than 3rd, and 3rd than 2nd.

NATAL: Durban (*C. N. Barker*).

TYPE in the Stockholm Museum.

68. H. SCABER, sp. nov.

Long. 16, lat. 7 mm.

Head convex, faintly punctured, forehead not flattened and with a central stria; anteocular furrows very deep. *Rostrum* not incised dorsally at base, as long as head and prothorax, strongly curved. Upper surface convex at base, shallowly excavate towards apex, coarsely punctured except for a smooth central line and with its edges narrowly carinate; lateral sulci not meeting at base, the upper pair narrow and shallow, the lower ones absent; scrobes directed beneath base of rostrum; inferior basal furrow obsolete. *Antennæ* with scape barely reaching eye; the two basal joints of funicle subequal. *Prothorax* as long as broad, apex rather narrower than base, sides strongly rounded, broadest about middle, dorsal anterior margin lobate, ocular lobes very strongly developed. Upper surface convex, set with large rounded tubercles, leaving a very distinct central furrow containing a strong carina; tubercles bare and shiny, each with a very short depressed seta, interstices with dense brown scaling. *Elytra* oblongo-ovate, shoulders rounded, sides very little rounded, broadest before middle, apical processes very short but acute. Upper surface convex, striæ with very regular rows of deep punctures without intervening granules; interval 1 with a row of granules which

become smaller posteriorly and vanish behind middle; intervals 4 and 6 quite plane; interval 2 smooth to beyond middle, but with a cristate row of six small tubercles on the declivity; interval 3 with a very regular row of closely-set rounded tubercles ceasing abruptly behind middle; intervals 5 and 7 with similar, but complete, rows, the tubercles on 5 slightly increasing, those on 7 decreasing, in size towards apex; tubercles bare, with very short depressed setæ, interstices with dense brown scaling. *Legs* with rather denser pale scaling and setæ; the joints of posterior tarsi of about the same width, 2nd and 3rd subequal in length, 1st longer.

Cape Colony.

Type in the British Museum.

The very regular, closely-set, rounded tubercles on the elytra give this insect a very distinct appearance from the other members of the *ferus*-group.

69. H. tricostatus Mshl. (Plate II. fig. 7.)

H. tricostatus Mshl. l. c. p. 411 (1902).

Long. 13, lat. 6 mm.

Head convex, finely and dispersely punctured, forehead with a small central fovea; anteocular furrows shallow and ill-defined. *Rostrum* not incised at base, about as long as head and prothorax, slightly curved. Upper surface without any furrow or carina, convex at base and faintly impressed towards apex, distinctly punctured except along a broad smooth central line; lateral sulci not meeting at base, the upper pair narrow but distinct, the lower pair almost obsolete; scrobes directed beneath base of rostrum; inferior basal furrow absent. *Antennæ* with scape not reaching eye; the two basal joints of funicle subequal. *Prothorax* as long as broad, the length much greater than the width at base, which is about equal to that at apex, sides gradually but strongly dilated from apex and suddenly narrowed near base, broadest far behind middle, ocular lobes strongly developed. Upper surface plane, with a very high, narrow, central carina, and on each side of it a broad, smooth, strongly raised costa, the costæ uniting at apex so as to form an elongate horseshoe, the ends of which are sometimes interrupted near the base; outside the costa is a broad smooth space followed by a lateral row of small closely-set single tubercles forming the most prominent part of the lateral dilatation; tubercles and costæ black and shiny, the interstices with brown scaling. *Elytra* ovate, shoulders sloping, sides moderately rounded, broadest rather before middle, apical processes in ♀ very short but sharp. Upper surface convex, with rows of foveæ, those in adjoining rows often merging so as to give the elytra the appearance of being strongly wrinkled transversely; intervals 1, 4, and 6 entirely without tubercles; interval 2 with a short apical row of four or five sharply conical tubercles; interval 3 with a row of five or six larger subconical tubercles ceasing behind middle; intervals 5 and 7 with complete rows of conical tubercles, those on the former much larger and sharper near apex; tubercles black.

shiny, and occasionally with short depressed apical setæ, the interspaces with uniform brown scaling. *Legs* with sparser pale scaling forming a denser ring near apex of femora; posterior tarsi narrow, setose, the three basal joints of the same width, 2nd and 3rd subequal in length, 1st longer.

CAPE COLONY.

TYPE in the British Museum.

The peculiar structure of the prothorax will differentiate *tricostatus* from every other species in the genus.

70. H. FERUS Gyl.

H. ferus Gyl. Schh. Gen. Curc. v. p. 758 (1840).

H. pollinarius Gyl. l. c. p. 759.

Long. 14–16, lat. 5½–7 mm.

Head convex, with indistinct punctuation and dense brown scaling, forehead with a faint impression; anteocular furrows distinct. *Rostrum* not incised at base, as long as head and prothorax, thick, strongly curved and dilated towards apex. Upper surface obscurely punctured and with dense brown scaling, the structure variable; in the typical form there is a deep and continuous central furrow, but this varies much in depth and in some examples it disappears almost entirely; lateral sulci not very deep, not uniting at base, subequal in length, the lower pair being rather shallower; scrobes deep, directed beneath base of rostrum; inferior basal furrow absent. *Antennæ* squamose, the scape not reaching eye; the first joint of funicle slightly longer than second. *Prothorax* rather transverse, the length greater than the width at base, which is equal to apex, sides strongly rounded, broadest about middle, dorsal anterior margin distinctly convex, ocular lobes well developed. Upper surface convex, irregularly set with large elevated tubercles, leaving a broad central furrow containing a distinct narrow carina, the tubercles adjoining the central furrow often subcristate; tubercles and interstices entirely covered with brown scaling, the former with short thick white depressed setæ. *Elytra* oblongo-ovate, rather narrower in ♂, shoulders subrectangular, sides scarcely rounded, apical processes very short and conical in both sexes. Upper surface convex, with rows of large indistinct punctures, separated by scale-covered granules; interval 1 with a row of granules disappearing behind; interval 2 usually with only a short subcristate row of conical tubercles from middle, or behind middle, to apex, but sometimes there are small tubercles almost up to the base; interval 3 with a row of closely-set conical tubercles, which is usually broadly interrupted on the declivity, but is occasionally continuous; intervals 4 and 6 quite plane; 5 and 7 with complete rows of elevated conical tubercles; the extreme apices only of tubercles bare and each with a short thick depressed white seta, the rest of the surface densely covered with uniform brown scaling. *Legs* with dense greyish squamæ; posterior tarsi with the joints of the same width, 2nd and 3rd subequal in length, 1st rather longer.

CAPE COLONY: Uitenhage (*Rev. J. O'Neil*), Algoa Bay (*Dr. H. Brauns*).

TYPE in the Stockholm Museum.

The type of *pollinarius* Gyl. from Drège's collection is in the Stockholm Museum, and it certainly has not a granulated rostrum as described by Gyllenhal. It differs from the type of *ferus* in having the rostrum convex at the base, the central furrow being there obsolete, and the tubercles on the prothorax are not so regularly arranged. The distinction given by Gyllenhal that the punctures on the elytra in *ferus* are replaced by granules in *pollinarius* is unreliable, for it depends largely upon the incidence of light upon the insect as to whether the striæ be regarded as coarsely punctured or granulate. The difference in the rostrum in extreme examples of the two forms is certainly noticeable, but in the series which I have examined there is so much variability in this respect that I cannot regard the character as of specific value.

71. H. MAMMILLATUS Gyl.

H. mammillatus Gyl. Schh. Gen. Curc. i. p. 476 (1833).

Long. 17–19, lat. 8¼–9 mm.

Head slightly convex, indistinctly punctured, sparsely squamose and with a central fovea near base of rostrum; anteocular furrows deep. *Rostrum* not incised at base, about as long as head and prothorax, thick, strongly curved. Upper surface convex at base, shallowly excavate towards apex, strongly punctured and squamose except along a smooth central line; lateral sulci distinct, subequal, not meeting at base; scrobes directed beneath base of rostrum; inferior basal furrow absent. *Antennæ* with dense brownish scaling; scape not reaching eye; the two basal joints of funicle subequal. *Prothorax* distinctly transverse, apex narrower than base, sides strongly dilated, retuse, broadest about middle, dorsal anterior margin slightly convex, ocular lobes strongly developed. Upper surface almost plane, with a shallow transverse impression just behind apex, set with small rounded distant tubercles, leaving a central furrow containing a low carina; the tubercles are more elevated laterally, have their apices bare and each with a depressed pale seta; interstices with dense brown scaling. *Elytra* broad, oblongo-ovate, shoulders roundedly prominent, sides subparallel to beyond middle, apical processes short and blunt in both sexes. Upper surface slightly convex, with rows of shallow punctures separated by scale-covered granules; interval 1 with a row of small shiny granules ceasing beyond middle; interval 2 with a row of granules to beyond middle and thence with closely-set conical cristate tubercles down the declivity, which is very steep; intervals 3, 5, and 7 with complete rows of small subconical tubercles, but that on the first is sometimes interrupted on the declivity; intervals 4 and 6 without tubercles or at most with one or two isolated ones; extreme apices only of tubercles bare and each with a pale depressed seta, interstices densely clothed

with large round light and dark brown scales. *Legs* with dense pale scaling and setæ; posterior tarsi broad, the joints subequal in length and breadth.

CAPE COLONY: Uitenhage (*Dr. H. Brauns*), Grahamstown.

TYPE in the Stockholm Museum.

This species is very similar to the preceding one, but the insects are distinctly larger and more robust; the prothorax is much broader and has its sides more strongly rounded; the tubercles on both prothorax and elytra are smaller and not nearly so conical.

72. H. LOBATUS Mshl. (Plate II. fig. 8.)

H. lobatus Mshl. l. c. p. 414 (1902).

Long. 23, lat. 10 mm.

Head convex, with scattered shallow punctures, vertex with dense scaling, forehead bare and with a central fovea; anteocular furrows distinct and complete. *Rostrum* not incised at base, about as long as head and prothorax, thick, gradually dilated to apex, strongly curved, its upper edge in profile being in a continuous line with the forehead from base to middle, then strongly deflexed at a sharp angle. Upper surface convex at base, deeply excavate anteriorly, its edges being strongly raised in the form of angulated carinæ, with large diffuse and shallow punctures leaving a broad smooth central line; lateral sulci shallow and indistinct, the upper one obsolescent; inferior basal furrow absent. *Antennæ* with dense brown scaling: scape not reaching eyes; the two basal joints of funicle subequal. *Prothorax* transverse, the length about equal to the width at base, the apex narrower, sides moderately rounded, broadest about middle, dorsal anterior margin convex, ocular lobes strongly developed. Upper surface plane, diffusely set with large elevated rounded tubercles, leaving a broad central furrow containing a distinct short carina; tubercles bare, with depressed setæ, the interstices covered with round whitish scales. *Elytra* oblongo-ovate, sides subparallel to beyond middle, shoulders roundedly prominent, apical processes in both sexes short but sharp and divergent. Upper surface convex, striæ with rows of small punctures with more or less distinct intervening granules; interval 1 with a row of distant granules; interval 2 with an abbreviated row of tubercles from before middle to apex, those on disk small and rounded, those on the declivity much larger and sharply conical; intervals 3, 5, and 7 with complete rows of small subconical tubercles, which become larger and more conical near apex; intervals 4 and 6 quite smooth; tubercles bare and with short pale depressed setæ, interspaces with thin brown scaling variegated with grey. *Legs* with dense pale scaling; posterior tarsi with the joints of about the same width, 1st a little longer than 2nd, and 2nd than 3rd.

NAMAQUALAND: O'okiep (*L. Péringuey*).

TYPE in the British Museum.

Resembles *H. mammillatus* Gyl. in general facies, but the

elytra are more elongate in shape, the posterior declivity being more gradual and the apical processes sharper. The elevation of the margins of the rostrum and the obsolescent upper lateral furrow are also distinctive characters.

73. H. EXILIS, sp. nov. (Plate II. fig. 10.)

Long. 14, lat. 6 mm.

Head with close shallow punctuation and dense brown scaling, convex; forehead not flattened, but with a central rounded impression; anteocular furrows very deep, but not convergent dorsally. *Rostrum* not incised at base, as long as head and prothorax, thick and strongly curved. Upper surface with a distinct central furrow throughout but much broader apically, without any central smooth line or carina, the shallow punctuation hidden by brown scaling; upper lateral sulci almost obsolete, lower ones deep and distinct; scrobes directed to beneath base of rostrum; inferior basal furrow absent. *Antennæ* with sparse scaling; scape scarcely reaching eye; the two basal joints of funicle subequal. *Prothorax* transverse, apex hardly narrower than base, sides strongly dilated but not acuminate, broadest behind middle, dorsal anterior margin convex, ocular lobes strongly developed. Upper surface almost plane, with large, rather distant, elevated tubercles, leaving a distinct central furrow containing a pronounced carina; apices of tubercles bare and with very short pale depressed setæ, interstices with dense scaling. *Elytra* ovate, shoulders sloping, sides distinctly rounded, broadest before middle, apical processes very short and blunt in ♀. Upper surface convex, the striæ with rows of large granules; interval 1 with a row of small distant tubercles ceasing behind middle; interval 2 with only an apical row of conical tubercles on the declivity; intervals 3, 5, and 7 with rows of subconical tubercles of nearly even height, that on 3 ceasing abruptly behind middle; intervals 4 and 6 without tubercles; apices of tubercles alone bare and with occasional short setæ, the rest of the surface clothed with brown or greyish scaling. *Legs* with thin setiform scaling; posterior tarsi with the joints of the same width, 2nd and 3rd subequal in length, 1st longer.

GABOON (? — *teste* Pascoe).

TYPE in the British Museum.

Very similar in appearance to *asper* Mshl., but differs in having distinct rows of granules on the reflexed margins of the elytra, in the faintness of the upper lateral sulcus on the rostrum and the complete absence of the inferior transverse basal furrow.

74. H. NYASÆ, sp. nov. (Plate III. fig. 1.)

Long. 16, lat. 7 mm.

Head convex, closely but shallowly punctured, forehead with a broad central depression; anteocular furrows deep, but not approaching dorsally. *Rostrum* about as long as head and prothorax, not incised dorsally at base, distinctly curved. Upper surface with a broad but shallow furrow throughout, which is

indistinctly punctured and covered with brown scaling; upper lateral sulci narrow, uniting at base, which has a small callus on each side above the anteocular furrows, lower lateral sulci broader and longer; scrobes directed to beneath base of rostrum; inferior basal furrow absent. *Antennæ* with the scape just reaching eye; the two basal joints of funicle subequal. *Prothorax* about as long as the width at base, apex rather narrower, sides dilated and obtusely angulated about middle, anterior margin dorsally truncate, ocular lobes well developed. Upper surface almost plane and with a transverse impression behind apex, fairly closely covered with small rounded tubercles, leaving a distinct central furrow containing a short but strong carina; tubercles bare, with depressed pale setæ, interstices with dense brown scaling. *Elytra* oblongo-ovate, shoulders sloping, sides slightly rounded, broadest about middle, apical processes very short and obtuse. Upper surface convex, with regular rows of shallow punctures separated by small granules; intervals uneven, the tubercles all small and subequal throughout; interval 1 with a row of granules vanishing behind middle; interval 2 with a few tubercles near base and a short subcristate row on the declivity; intervals 3, 5, and 7 with complete rows of small closely-set tubercles; intervals 4 and 6 plane, or at most with one or two isolated tubercles; tubercles and granules bare and each with a depressed pale seta, interstices clothed with elongate setiform brown scaling. *Legs* with sparse pale scaling and setæ, forming a denser ring near apex of femora; posterior tarsi with the joints of the same width, 2nd and 3rd subequal in length, 1st distinctly longer.

Brit. Cent. Africa: Fwambo.

Type in the British Museum.

75. H. angolensis, sp. nov. (Plate III. fig. 4.)

Long. 16 19, lat. 7½–9¼ mm.

Head convex, closely but shallowly punctured and with dense brown scaling, forehead with a broad and deep depression; anteocular furrows deep, but entirely lateral in position. *Rostrum* not separated from head by a deep dorsal incision, about as long as head and prothorax, distinctly curved. Upper surface with a shallow central furrow throughout, its edges carinate to beyond middle, with close shallow punctuation and dense brown setæ; lateral sulci deep, the upper pair meeting at base, where there is a slight callus above the anteocular furrows, the lower pair rather longer and broader; scrobes directed to beneath base of rostrum; inferior basal furrow absent. *Antennæ* with the scape not reaching eye; the two basal joints of funicle subequal. *Prothorax* transverse, the length about equal to the width at base, apex narrower, sides dilated and bluntly angulated about middle, dorsal anterior margin slightly convex, ocular lobes well developed. Upper surface rather convex, with a transverse impression behind apex, unevenly set with small rounded tubercles, leaving a central furrow containing a distinct carina; tubercles bare, with depressed

pale setæ, interstices with dense brown scaling. *Elytra* broadly ovate, shoulders sloping, sides strongly rounded, broadest about middle, apical processes short and blunt in both sexes. Upper surface convex, with regular rows of shallow punctures separated by distinct granules; intervals dissimilar, all tubercles small and subequal throughout; interval 1 with a row of small granules disappearing behind middle; interval 2 with a few tubercles at base and a short subcristate row on the declivity; intervals 3, 5, and 7 with more or less duplicated rows of small tubercles which are agglomerated so as to form strong costæ; intervals 4 and 6 plane; tubercles bare, with short depressed pale setæ; scaling rather narrow, sparse and light brown in colour. *Legs* with scattered pale scaling and setæ, forming a denser ring near apex of femora; posterior tarsi with joints of the same width, 2nd and 3rd subequal in length, 1st longer.

ANGOLA: Huilla (*Dr. Welwitsch*).

TYPE in the British Museum.

The Angolan representative of *H. wahlbergi* Boh., but its very short subglobose elytra (especially in the ♀) give it a very different appearance from any of its allies.

76. H. OVAMPOENSIS Pér.

H. ovampoensis Pér. Trans. S. Afr. Phil. Soc. 1892, p. 75.

Long. 17–22, lat. 8–10½ mm.

Head closely but faintly punctured and with dense brown scaling, vertex convex, forehead slightly flattened and with an elongate central fovea; anteocular furrows very deep, strongly convergent above, only separated from the central fovea by a narrow costa. *Rostrum* not incised at base, about as long as head and prothorax, distinctly curved. Upper surface coarsely punctured and with suberect dark setæ, a narrow shallow central furrow throughout; upper lateral sulci narrow and evidently united at base, lower sulci broader, deeper and longer; scrobes directed beneath base of rostrum; inferior basal furrow present. *Antennæ* with scape scarcely reaching eye; the two basal joints of funicle subequal. *Prothorax* rather longer than the width at base, which is broader than apex, sides dilated and with a sharp tubercular projection about middle, anterior margin slightly convex, ocular lobes well developed. Upper surface convex, fairly closely set with small rounded tubercles, leaving an indistinct central furrow containing a short low carina; tubercles bare and with depressed pale setæ, interstices with dense brown scaling. *Elytra* very short ovate in both sexes, shoulders sloping, sides strongly rounded, broadest about middle, apical processes short and acuminate in both sexes. Upper surface convex, striæ with rows of ill-defined punctures separated by granules; interval 1 with a row of minute distant granules; interval 2 usually smooth to beyond middle, where there are one or two small isolated tubercles and a subcristate row of larger tubercles on the declivity; interval 3 with a row of small subconical tubercles, usually ceasing

behind middle but sometimes continued to apex and more or less duplicated and agglomerated in the basal half; intervals 5 and 7 with similar, but complete rows; 4 and 6 smooth, or at most with a few small isolated tubercles; apices of tubercles bare and with dark depressed setæ, interstices with dense brown setiform scaling. *Legs* with scattered brown scaling and setæ, forming a denser ring near apex of femora; posterior tarsi with the joints of about same width, 2nd and 3rd subequal in length, 1st longer.

ANGOLA: Huilla, 3800–5500 ft. (*Dr. Welwitsch*). OVAMPOLAND (*A. W. Eriksson*).

TYPE in the South African Museum.

Allied to *wahlbergi* Boh., but differs in its strongly convergent anteocular furrows, the narrow and shallow thoracic furrow, and the presence of an apical row of tubercles on interval 2 of the elytra.

77. H. ASPER Mshl. (Plate III. fig. 2.)

H. asper Mshl. l. c. p. 445 (1902).

Long. 11–12, lat. 4½–5 mm.

Head convex, vertex closely and finely punctured and with dense fulvous scaling, forehead bare, dispersely punctured and with a distinct central fovea; anteocular furrows distinct. *Rostrum* not incised at base, about as long as head and prothorax, curved and dilated to apex. Upper surface with a distinct central furrow, which is narrow at base and dilated anteriorly, its sides being bluntly costate, distinctly punctured except on a smooth narrow central line, the punctures bearing depressed setæ; lower lateral sulci almost obsolete, the upper ones distinct and meeting at base; scrobes directed beneath base of rostrum; inferior basal furrow shallow. *Antennæ* with scape not reaching eye; the two basal joints of funicle subequal. *Prothorax* broader than long, apex about as wide as base, sides strongly dilated before middle owing to the presence of several large lateral tubercles, dorsal anterior margin convex, ocular lobes strongly developed. Upper surface convex, with large elevated tubercles, bearing depressed setæ and leaving a deep central furrow containing a strong carina and with its margins subcostate; the interstices with fulvous scaling. *Elytra* ovate, shoulders roundedly prominent, sides slightly rounded, broadest about middle, apical processes short and blunt in both sexes. Upper surface convex, with regular rows of foveæ separated by small granules; interval 1 with an indistinct row of granules vanishing behind middle; interval 2 with only three to five prominent tubercles on the declivity; interval 3 with a row of seven or eight elevated tubercles terminating abruptly just behind middle; 4 and 6 smooth; 5 and 7 with regular and complete rows of elevated tubercles; scaling sparse, variegated brown and fulvous. *Legs* with scattered scales and a denser pale ring near apex of femora; posterior tarsi with the joints of about the same width, 2nd and 3rd subequal in length, 1st longer.

NATAL. TRANSVAAL: Lydenburg.

TYPE in the British Museum.

78. H. WAHLBERGI Boh.

H. wahlbergi Boh. Schönh. Gen. Curc. viii. 2, p. 376 (1845).

Long. 13–21, lat. 6–10 mm.

Head shagreened, with moderately dense brown scaling, vertex convex, forehead broadly and deeply excavate; anteocular furrows distinct. *Rostrum* not transversely incised at base, as long as head and prothorax, distinctly curved and dilated near apex. Upper surface finely punctured and with depressed brown setæ, with a central furrow, dilated towards apex and which in some examples is deep throughout, in others shallower, or even almost obsolete towards base; lateral sulci distinct, the upper pair uniting at base; scrobes deep and directed beneath base of rostrum; inferior basal furrow distinct. *Antennæ* with scape not reaching eye; the two basal joints of funicle subequal. *Prothorax* transverse, scarcely longer than the width at base, which is rather broader than the apex, sides dilated into a sharp angular projection about middle, dorsal anterior margin truncate, ocular lobes well developed. Upper surface almost plane, closely set with elevated tubercles, leaving a deep central furrow containing a strong carina and with its margins subcostate; tubercles bare, each with a depressed fulvous seta, the interstices with thin brown scaling. *Elytra* ovate, shoulders sloping, sides rounded, broadest about middle, apical processes short and sharp in ♀, but often much reduced and blunt, absent in ♂. Upper surface convex, with regular rows of large deep punctures becoming shallower laterally; intervals 1, 3, 5, and 7 strongly costate and with rows of small closely-set, or even agglomerated, tubercles, which are separated and more conical near apex; the remaining intervals quite plane and devoid of tubercles; tubercles bare and with depressed fulvous setæ, the interspaces sparsely variegated with light and dark patches of scaling. *Legs* with very thin pale scaling and a denser ring near apex of femora; posterior tarsi with the joints of the same width, the 2nd and 3rd subequal in length, 1st longer.

NATAL: Durban (*C. N. Baker*), Estcourt, Drakensberg. TRANSVAAL: Lydenburg (*Dr. J. W. B. Gunning*).

TYPE in the Stockholm Museum.

A very common species in Natal and varying a good deal both in size and appearance. In some examples the tubercles on the elevated intervals of the elytra seem to be worn down so that the intervals are almost simply costate, and owing to the deep punctures the sculpturing of the elytra has thus a strongly reticulate appearance.

79. H. SERRATUS Mshl. (Plate III. fig. 3.)

H. serratus Mshl. l. c. p. 446 (1902).

Long. 11, lat. 5 mm.

Head convex, with dense fulvous scaling on vertex; forehead bare, faintly punctured, and with a rounded central depression; anteocular furrows very deep. *Rostrum* not incised at base,

about as long as head and prothorax, stout and slightly curved. Upper surface convex in basal half, almost plane anteriorly, without any central furrow or carina, with deep setigerous punctuation leaving a narrow smooth central line; lower lateral sulci faint, the upper ones much longer and deeper, meeting at base; scrobes directed beneath base of rostrum; inferior basal furrow deep. *Antennæ* with scape not quite reaching eye; the two basal joints of funicle subequal. *Prothorax* about as long as broad, base and apex of equal width, sides strongly rounded, broadest rather before middle, ocular lobes well developed. Upper surface convex, with comparatively large, separated, subconical tubercles, leaving a broad central furrow containing a well-developed carina; tubercles bare, shiny, each with a short depressed seta, the interstices with fulvous scaling, paler laterally. *Elytra* oblongo-ovate, shoulders roundedly prominent, sides very slightly rounded, broadest just behind shoulders; apical processes very short and blunt in ♀. Upper surface convex, with regular rows of foveæ occasionally interrupted by faint granules; interval 1 without distinct granules; interval 2 with only a short apical row of four or five sharply conical tubercles; interval 3 with a basal row of rather smaller subconical tubercles terminating about middle; 4 and 6 plane; 5 and 7 with complete rows of sharp conical tubercles; the tubercles, which are of nearly equal size throughout, are bare and shiny, and each with a depressed apical seta, the interspaces with dark brown scaling variegated with lighter patches. *Legs* with dark scaling and setæ, except for a ring of white scales near apex of femora; posterior tarsi with the joints of about the same width, 2nd and 3rd subequal in length, 1st rather longer.

TRANSVAAL: Lydenburg.

TYPE in the British Museum.

80. H. DEPLORABUNDUS Fåhr.

H. deplorabundus Fåhr. Öfv. K. Vet.-Ak. Förh. p. 209 (1871).

Long. 13, lat. 5¼ mm.

Head convex, with close shallow punctures and dense fulvous scaling, forehead with an elongate fovea; anteocular furrows deep. *Rostrum* not incised dorsally at base, as long as prothorax only, moderately curved, upper surface coarsely punctured, with scattered pale scaling and a complete central furrow, which is narrow near base but broadly dilated beyond middle, its edges being there bluntly carinate; lateral sulci shallow and indistinct, the upper pair meeting at base which is slightly raised; scrobes broad and deep, directed beneath base of rostrum; inferior basal furrow distinct. *Antennæ* with scape not reaching eye; the two basal joints of funicle subequal. *Prothorax* about as long as broad, apex a little narrower than base, sides strongly rounded, broadest before middle, anterior margin slightly convex, ocular lobes very strongly developed. Upper surface rather convex, with elevated rounded tubercles, not very closely set, leaving a

narrow but deep central furrow containing a faint carina which is more or less hidden by scaling; tubercles bare at their apices only, each with a depressed pale seta; scaling dense, fulvous, except at the sides and in the central furrow where it is white. *Elytra* ovate, shoulders roundedly prominent, sides not much rounded, broadest about or before middle, apical prominences very short and blunt. Upper surface convex, with regular rows of rather ill-defined foveæ; intervals dissimilar, all tubercles small, those near sides and apex subconical; interval 1 with a row of small scale-covered granules terminating at middle; interval 2 with only a short apical row of tubercles; intervals 4 and 6 smooth; 3, 5, and 7 with regular and complete rows of tubercles; tubercles bare at their extreme apices only, each with a depressed pale seta; scaling dense, dark brown, variegated with three ill-defined patches on each elytron, viz. a large one at base, another on the declivity, and a much smaller one about middle. *Legs* with scattered pale setæ and scaling, forming a denser ring near apices of femora; posterior tarsi narrow, setose, the joints of the same width, 2nd and 3rd subequal in length, 1st longer.

TRANSVAAL: Lydenburg (*Dr. J. W. B. Gunning*).

TYPE in the Stockholm Museum.

81. H. CRISPATUS F.

Curculio crispatus F. Spec. Ins. i. p. 194 (1781); Herbst, Col. vi. p. 322, t. 85. f. 7 (1795); Ol. Ent. v. 83, p. 389, t. 13. f. 160 (1807).

Long. 15–19, lat. 7–9½ mm.

Head convex, with deep reticulate foveæ and sparse brown scaling, forehead with a distinct longitudinal impression; anteocular furrows obsolescent. *Rostrum* not incised at base, as long as prothorax, dilated near apex, gently and evenly curved. Upper surface with large reticulate foveæ and thin brownish scaling throughout, the lateral sulci being obliterated by the foveæ; scrobes deep, directed beneath base of rostrum; inferior basal furrow shallow. *Antennæ* with scape not reaching eye; the two basal joints of funicle subequal. *Prothorax* slightly transverse, apex narrower than base, sides rounded, broadest about middle, dorsal anterior margin convex, ocular lobes well developed. Upper surface convex, set with small agglomerated tubercles, forming more or less regular rows and leaving a deep central furrow containing an abbreviated carina; the tubercles adjoining the central furrow forming a distinct ridge, each with a thick depressed pale seta, the interstices with fairly dense greyish or brownish scaling. *Elytra* oblongo-ovate, narrower in ♂, shoulders sloping, sides not much rounded, broadest about middle, apical processes very short and conical in both sexes. Upper surface convex, with regular rows of large subreticulate punctures; interval 1 with a row of small tubercles from about middle to apex; intervals 2, 4, and 6 usually plane, but occasionally with more or less complete rows of low, widely separated tubercles;

intervals 3, 5, and 7 with complete rows of small, closely-set, conical tubercles, which become larger and sharper behind; apices of tubercles not bare, each with a depressed pale seta, the whole surface fairly densely covered with brown or grey scaling. *Legs* coarsely punctured and with sparse pale scaling; posterior tarsi broad, setose, the joints of the same width, 2nd and 3rd subequal in length, 1st longer.

Cape Colony.

Type in the British Museum (coll. *Banks*).

Fabricius' type is larger than any other specimen which I have seen and has the rows of tubercles on the intervals 2, 4, and 6 unusually well developed. Schönherr was unable to recognise this species, but I found three examples of it in the Stockholm Museum. It appears, however, to be a rare insect.

82. H. infacetus Gyl.

H. infacetus Gyl. Schh. Gen. Curc. i. p. 480 (1833); Labr. & Imh. Gen. Curc. ii. no. 34 (1848).

Long. 12–20, lat. 6–9 mm.

Head convex, with scattered coarse punctures and pale scales, forehead with a broad and deep central furrow; anteocular furrows shallow. *Rostrum* not incised at base, scarcely as long as prothorax, distinctly angulated beyond middle. Upper surface plane near apex, but with a broad shallow central furrow in the basal half, sometimes containing a faint carina, with shallow punctuation and sparse pale scaling; upper lateral sulci very deep and meeting at base, thus throwing into prominence the edges of the central furrow, lower sulci curved and longer but very shallow; scrobes lateral but oblique; inferior basal furrow absent. *Antennæ* with scape scarcely reaching eye; the two basal joints of funicle subequal. *Prothorax* longer than broad, apex narrower than base, sides not much rounded, broadest about middle, anterior margin convex, ocular lobes well developed. Upper surface with a strong but abbreviated central carina contained in a broad and deep furrow, the sides of which are formed by a row of more or less agglomerated tubercles; the lateral portions set with low rounded tubercles arranged in three irregular rows leaving smooth narrow interspaces; tubercles bare and with short depressed dark setæ, the interstices with dense brown scaling. *Elytra* broadly ovate, shoulders sloping, sides not much rounded, broadest about middle, apical processes very short and obtuse in both sexes, basal margin deeply sinuate, scutellum very distinct and covered with pale scaling. Upper surface convex, with regular rows of shallow punctures separated by large granules; interval 1 costate and with a row of small very depressed and elongate tubercles ceasing behind middle; intervals 2, 4, and 6 plane and without tubercles; 3, 5, and 7 costate and with complete rows of tubercles, those in the basal part of 3 and 5 more or less strongly depressed and elongate, the rest conical; tubercles bare and usually with very short depressed dark setæ,

the interspaces evenly covered with brown and yellowish scaling. *Legs* coarsely punctured and with sparse pale scaling; posterior tarsi narrow, the joints of the same width, 2nd and 3rd subequal in length, 1st much longer.

CAPE COLONY: Cape Town.

TYPE in the Stockholm Museum.

In general facies this species is very similar to *crispatus* F., and the two appear to be generally confused in collections; the rostrum, however, offers several good distinctive characters, as a comparison of the descriptions will show.

83. H. FRONTALIS Sparrm.

Curculio frontalis Sparrm. Act. Holm. i. p. 47, t. 2. f. 14 (1785).

H. frontalis Gyl. Schh. Gen. Curc. i. p. 479 (1833); Fåhr. Schh. l. c. v. p. 757 (1840).

Long. 11–22, lat. 5–10 mm.

Head deeply and rugosely punctured, convex on vertex, forehead with a broad and very deep excavation; anteocular furrows absent. *Rostrum* not incised at base, about as long as prothorax, thick, not much curved and slightly dilated towards apex. Upper surface rugosely punctate, usually with a shallow central furrow in the basal half, which is sometimes absent; upper lateral sulci broad and deep, uniting at base, the lower pair obsolete; scrobes deep, lateral and oblique; inferior basal furrow absent. *Antennæ* with scape barely reaching eye; the two basal joints of funicle subequal. *Prothorax* transverse, apex narrower than base, sides ampliated to behind middle and then more or less sharply constricted, the ampliation thus often forming a distinct angular projection, dorsal anterior margin slightly convex, ocular lobes moderate. Upper surface almost plane, with a deep central furrow, usually containing a faint trace of a carina, on each side of the furrow a regular and often subcristate row of tubercles, followed by a broad smooth space and then a less lateral row of tubercles, some of which form the lateral angulation; tubercles bare, without setæ, the interstices with thin greyish or brownish scaling. *Elytra* oblongo-ovate, scarcely narrower in ♂, shoulders subrectangular, sides scarcely rounded, apical processes very short and conical in both sexes. Upper surface convex, with regular rows of deep punctures, sometimes separated by low granules; interval 1 very narrow, occasionally with a few granules; interval 2 with a row of distant tubercles from apex nearly to base, those near apex much larger and more conical—very rarely this row is entirely absent; intervals 3, 5, and 7 with complete rows of closely-set conical tubercles; 4 and 6 devoid of tubercles, or at most with one or two isolated ones; tubercles bare, without setæ, the interspaces with moderately dense brownish or greyish scaling. *Legs* coarsely punctured and with sparse white scales; posterior tarsi broad, the joints of the same width, 2nd and 3rd subequal in length, 1st longer.

Cape Colony: Algoa Bay (*Dr. H. Brauns*), Cape Town and Stellenbosch (*L. Péringuey*).

Type in the Stockholm Museum.

A very variable species both in size and sculpturing.

84. H. tuberosus Gyl.

H. tuberosus Gyl. Schh. Gen. Curc. v. p. 768 (1840).

Long. 15, lat. 7 mm.

Head convex on vertex, forehead impressed, with a short deep central furrow and strong plications converging towards it, punctuation coarse and close; anteocular furrows absent. *Rostrum* not incised at base, short and thick, shorter than prothorax, not much curved. Upper surface closely punctured, with a strong smooth central carina, which is often bifid beyond middle, and a less distinct strongly punctured carina close on each side of it; lateral sulci distinct, the upper pair broader and meeting at base; scrobes lateral, oblique; inferior basal furrow absent. *Antennæ* with scape just reaching eye; 2nd joint of funicle longer than 1st. *Prothorax* broader than long, apex and base of equal width, sides strongly rounded, broadest about middle, ocular lobes small. Upper surface plane, thinly set with round flattened tubercles (more conical at sides), which leave a broad central, and two lateral, smooth bands, the former containing a short but thick carina; tubercles bare, unipunctate, but without setæ; interstices closely and deeply punctured, and with large grey scales. *Elytra* ovate, shoulders sloping, sides somewhat rounded, broadest about middle, apices slightly but simply divergent. Upper surface convex, with rather irregular rows of large shallow punctures, without intervening granules; intervals 3, 5, and 7 with complete rows of shiny tubercles, rounded on disk, bluntly conical towards the sides and apex; interval 1 with an incomplete row of granules; intervals 2, 4, and 6 each with one or two isolated tubercles; tubercles bare, shiny, rarely with apical setæ, interstices with rounded greyish scales which are denser on disk and towards base. *Legs* thick, coarsely punctured, except the middle part of femora which is almost smooth; tibiæ with long black setæ; posterior tarsi short and thick, joints of equal width, the first a little longer than the next two, which are subequal.

Cape Colony.

A distinct species with no very close affinities.

85. †H. pilosus, sp. nov.

Long. 15, lat. 7 mm.

Head convex on vertex and with dense depressed pale setæ, forehead slightly flattened, with a distinct central carina and a few long erect black setæ, anteocular furrows deep and convergent dorsally. *Rostrum* not incised at base, as long as head and prothorax, curved, parallel-sided almost to apex, with sparse depressed pale setæ and long erect black ones. Upper surface

coarsely punctured, with three prominent narrow smooth carinæ; lateral sulci deep, the upper pair uniting at base, longer and much broader than the lower pair; scrobes deep, lateral and oblique, inferior basal furrow absent. *Antennæ* with scape just reaching eye; the two basal joints of funicle very short, subequal. *Prothorax* comparatively small, somewhat transverse, apex rather narrower than base, sides very little rounded, broadest rather before middle, dorsal anterior margin truncate, ocular lobes feeble. Upper surface convex, fairly closely set with low rounded granules, leaving a shallow central furrow containing a short but strong carina; granules shiny, bearing long erect black setæ anteriorly, but with short depressed setæ behind, the interstices with dense brown scaling. *Elytra* ovate, shoulders roundedly prominent, sides somewhat rounded, broadest about middle, apical processes absent in ♂. Upper surface convex, with shallow sulci containing rows of ill-defined punctures often separated by minute granules; all the intervals with regular rows of closely-set granules, but 1, 3, 5, and 7 are more raised than the others, the granules also on them are larger and bear long erect black setæ, whereas the granules on the alternate intervals have much shorter subdepressed setæ; the apices of granules bare, the interspaces with dense brown scaling. *Legs* coarsely punctured and with fairly dense depressed pale setæ; posterior tarsi short and broad, the joints of about the same width, 2nd and 3rd subequal in length, 1st rather longer.

CAPE COLONY: Fraserburg.

TYPE in the South African Museum.

86. H. THORACICUS Fåhr.

H. thoracicus Fåhr. Schh. Gen. Curc. v. p. 767 (1840).

Long. 10–12, lat. 4–6 mm.

Head closely but shallowly punctured and with dense fulvous scaling, vertex convex; forehead strongly flattened, with a short deep stria near rostrum, dilating into a broad shallow impression higher up; anteocular furrows narrow but deep. *Rostrum* not incised at base, as long as head and prothorax, slightly curved, dilated only close to apex. Upper surface punctate and with thin scaling, with a shallow central furrow throughout containing a faint carina, and with a prominent carina on either side of it; upper lateral sulci uniting at base, much longer and deeper than the lower pair; scrobes lateral, deep in front and shallow behind; inferior transverse basal furrow absent. *Antennæ* clothed with pale depressed setæ; scape just reaching eye; second joint of funicle longer than first. *Prothorax* distinctly transverse, apex and base of equal width, sides slightly rounded, broadest about middle, dorsal anterior margin concave, ocular lobes well developed. Upper surface convex, the anterior margin distinctly elevated, with a broad smooth central furrow containing no carina, and on each side of it three regular separated rows of long spiniform tubercles, there being from 4 to 6 in each row, and those in the lateral row being much shorter than the others; tubercles bare

and with rather long subdepressed pale setæ, the interspaces with dense greyish-brown scaling. *Elytra* oblongo-ovate, very narrow in ♂, shoulders sloping, sides subparallel to beyond middle, apical processes very short in ♀, absent in ♂. Upper surface convex, with regular rows of small shallow punctures; interval 1 with a row of depressed setæ disappearing near apex; intervals 2, 4, and 6 each with only a very short apical row of small tubercles, that on 2 subcristate; intervals 3, 5, and 7 with costate rows of small closely-set tubercles, those on the two former ceasing abruptly behind middle; only the extreme apices of tubercles bare and each with a depressed pale seta, the interspaces with dense uniform pale greyish-brown scaling. *Legs* with fine white pubescence and scattered white setæ; posterior tarsi narrow, the 3rd joint rather broader than 2nd, 1st joint longer than 2nd, and 2nd than 3rd.

Cape Colony.

Type in the Stockholm Museum.

87. H. aculeatus Mshl. (Plate III. fig. 7.)

H. aculeatus Mshl. l. c. p. 455 (1903).

Long. 12, lat. 5 mm.

Head broadly and deeply excavated, densely clothed with brown scaling, the vertex, a narrow central line, and a ring round the eye paler and with a metallic reflection; a short fine central stria between the eyes; anteocular furrows narrow but deep, approximated dorsally. *Rostrum* not incised at base, as long as head and prothorax, slightly curved, its upper outline very strongly angulated beyond middle. Upper surface convex, densely covered with pale scaling, 5-sulcate, the carinæ edging the central furrow being gradually raised so as to form a sharp angular prominence beyond middle; lateral sulci deep and distinct, the upper pair meeting at base; scrobes straight and directed beneath base of rostrum; inferior basal furrow present, but not strongly marked. *Antennæ* with scape barely reaching eye; the two basal joints of funicle subequal. *Prothorax* as long as its width at base, very little narrower at apex, sides not much rounded, broadest about middle, ocular lobes moderately developed. Upper surface not very convex, with a broad median furrow (without a carina) and on each side of it three regular rows of long cylindrical spine-like tubercles, each row containing five; the whole surface densely clothed with brown scales, except the extreme apices of the tubercles, each of which bears a long depressed seta. *Elytra* elongato-ovate, sides not much rounded, broadest about middle, apical declivity longer and more abrupt than usual, apical processes absent. Upper surface very convex, with regular rows of punctures, somewhat obscured by the dense brownish scaling; the intervals slightly and equally costate, each with a regular row of small scale-covered setigerous granules, those on interval 2 slightly cristate on the declivity only. *Legs* elongate, with dense grey scaling and scattered pale setæ; posterior tarsi with the 2nd joint a little narrower than the other two, 2nd and 3rd subequal in length, 1st slightly longer.

CAPE COLONY: Grahamstown (coll. *Pascoe*).

TYPE in the British Museum.

Closely allied to the aberrant *thoracicus* Fåhr., from which it may be distinguished, among other points, by the dorsal angulation of the rostrum, the inferior direction of the scrobe, the more deeply excavate head, the more declivous and less strongly costate elytra, and the shorter tarsi.

88. H. SPINICOLLIS Gyl.

H. spinicollis Gyl. Schh. Gen. Curc. v. p. 766 (1840).

Long. 13, lat. 6 mm.

Head very strongly flattened, or even shallowly excavate, in front, with a short but deep central stria near base of rostrum; punctuation close but faint, usually hidden by dense brown scaling; anteocular furrows distinct. *Rostrum* comparatively slender, rather longer than head and prothorax, not incised transversely at base, distinctly curved. Upper surface with a continuous central furrow containing a fine smooth carina, which, however, is variable, being sometimes almost obsolete, the edges of the furrow are obtusely costate and set with distant granules; lateral sulci deep, the upper pair rather longer and uniting at base, which is slightly raised, the lower pair curved strongly upwards at base; scrobes directed beneath base of rostrum; inferior basal furrow distinct. *Antennæ* with scape scarcely reaching eye; the two basal joints of funicle subequal. *Prothorax* transverse, apex a little narrower than base, sides moderately rounded, broadest about middle, anterior margin truncate and distinctly reflexed, ocular lobes not very prominent. Upper surface rather convex, with six regular rows of four to six long cylindrical spiniform tubercles and usually a smaller and abbreviated lateral row; central furrow distinct, but shallow and without a carina; tubercles bare, each with a pale depressed seta, interstices with sparse scaling; sides of prosternum set with low granules. *Elytra* oblongo-ovate, shoulders rounded, sides subparallel to beyond middle, apical processes short, sharp, and widely separated. Upper surface rather convex, with rows of large but shallow punctures, often separated by intervening granules; interval 1 with a row of scattered granules; interval 2 with a short apical row of small, but more or less strongly cristate, tubercles; intervals 3, 5, and 7 with rows of small closely-set subconical tubercles, those on the two former vanishing behind middle; 4 with a few scattered tubercles and a very short subcristate row on the declivity; 6 with a row of rather distant conical tubercles, abbreviated in the basal half; apices of tubercles bare, each with a depressed pale seta; scaling dense, earth-brown. *Legs* with dense brown scaling and scattered pale setæ; posterior tarsi rather narrow, the 2nd joint a trifle narrower than the others, 2nd and 3rd subequal in length, 1st a little longer.

CAPE COLONY: Algoa Bay (*Dr. H. Brauns*).

The granulation of the rostrum is a very unusual character in

the genus, and this, in conjunction with the spiniform tubercles of the prothorax, renders the species readily recognisable.

89. H. SERIESPINOSUS Gyl.

H. seriespinosus Gyl. Schh. Gen. Curc. i. p. 477 (1833); Fåhr. op. c. v. p. 799 (1840).

H. perfunctorius Gyl. op. c. v. p. 763 (1840).

Long. 11–14, lat. 4½–6 mm.

Head closely punctured and with dense brown scaling, convex on vertex, forehead with a broad shallow impression; anteocular furrows deep, rather convergent above. *Rostrum* not incised dorsally at base, slightly curved and dilated towards apex. Upper surface densely squamose, with a deep central furrow throughout containing no carina, and two narrow elevated carinæ on each side, bearing rows of depressed pale setæ; upper lateral sulci long, deep and uniting at base, the lower pair shorter and shallower; scrobes deep, lateral, but rather intermediate in character; inferior basal furrow deep. *Antennæ* squamose, scape just reaching eye; the two basal joints of funicle subequal. *Prothorax* transverse, apex a trifle narrower than base, sides rounded, broadest at middle, dorsal anterior margin rather concave, ocular lobes well developed. Upper surface convex, rather sparingly set with elevated conical tubercles, bearing thick depressed white setæ, and leaving a narrow central furrow which contains no carina and is often indistinct; apices only of tubercles bare, the interstices with fairly dense greyish scaling. *Elytra* ovate, a little narrower in ♂, shoulders subrectangular, sides scarcely rounded, broadest about middle, apical processes obsolescent in ♂, variable in ♀, being sometimes short, sharply spiniform and subparallel, in others twice as long and contiguous, with varying intergrades. Upper surface convex, with rows of large shallow punctures, separated by distinct scale-covered granules; interval 1 with a row of granules; 2 with only a short apical row of small tubercles, that at the top of the declivity being larger than the others; 3 and 5 each with a row of small, very closely placed, conical tubercles, becoming more separated towards apex, and the former having a single much larger tubercle at the summit of the declivity; 4 and 6 plane, or rarely with one or two isolated small tubercles; 7 with a complete row of small, distant, conical tubercles; tubercles with only their extreme apices bare and each with a thick depressed white seta, the interspaces with dense brownish or greyish scaling. *Legs* densely and uniformly squamose; posterior tarsi with the joints of about the same width, 2nd and 3rd subequal in length, 1st longer.

CAPE COLONY: Uitenhage and Grahamstown (*Rev. J. A. O'Neil*), Algoa Bay (*Dr. H. Brauns*), Mossel Bay [S. A. Mus.].

TYPE in the Stockholm Museum.

After examining the typical specimens of *perfunctorius* Gyl. from Drège's collection at Stockholm, I could not regard them as specifically distinct from the present species.

Father O'Neil states that this species is common in his neighbourhood, being found under stones or heaps of dead leaves in damp spots.

90. †H. CARINIROSTRIS Gyl.

H. carinirostris Gyl. Schönh. Gen. Curc. v. p. 762 (1840).

"Very similar and closely related to *H. binodis*, but half as big again; moreover there is a low carina in the central furrow of the rostrum, and the central carina on the thorax is wanting.

"*Head* rounded, closely and finely shagreened, black, with grey scaling, the forehead broadly impressed; eyes lateral, ovate, moderately convex, without supra-ocular ridges. *Rostrum* nearly twice as long as head, thick, curved, subconstricted at the base, with five sulci above, the central one broader anteriorly and containing a low shiny carina, the lateral ones decreasing in length outwardly; colour black with fuscous scaling, obsoletely punctate. *Antennæ* of medium length, black, with dark setæ. *Thorax* broader than long, broadly emarginate anteriorly, sides strongly rounded, base truncate. Upper surface slightly convex, set with numerous elevated subconical tubercles, each of which bears a pale depressed apical seta; there is no space on the disk free of tubercles and containing a carina, as is the case with *H. binodis*; colour black, with dark scaling in the cavities. Scutellum triangular, black, squamose. *Elytra* anteriorly half as broad again as the base of thorax, shoulders almost rectangular, sides somewhat ampliated, attenuated behind, the apices separately subacuminate or with a small tubercular process, four times as long as the thorax, convex above, declivous behind, with rows of large remote punctures, the alternate intervals, viz. the second, fourth, and sixth from suture [the third, fifth, and seventh in my terminology—G. A. K. M.], subcostate, set with numerous tubercles bearing depressed pale setæ, those on disk smaller and obtuse, the posterior ones more elevated and conical, of which one on the second [third] interval, behind middle, is larger than the others; on the interval next the suture [second] may be seen towards the apex a row of six or eight tubercles; colour black, with dark scaling in the cavities. Body beneath closely but obsoletely punctured and granulate, black, with grey and fuscous scaling. *Legs* of medium size, obsoletely punctured, black with grey scaling.

"AFRICA (*Lalande*). Described from the Paris Museum."

I have been unable to examine the type of this species, and I have not succeeded in recognising it among the various collections to which I have had access. The above is a translation of Gyllenhal's own description. The species is clearly a very close ally of *seriespinosus* Gyl., and the only character given in the description by which it can be differentiated is the presence of the central carina on the rostrum.

91. H. AFFINIS Fåhr.

H. affinis Fåhr. Öfv. K. Vet.-Ak. Förh. p. 208 (1871).

Long. 13 16, lat. 6 7 mm.

Head covered with dense brown scaling, convex on vertex, forehead broadly but shallowly depressed and with a small elongate fovea near rostrum; anteocular furrows distinct. *Rostrum* not incised dorsally at base, scarcely as long as head and prothorax, slightly curved, dilated apically. Upper surface with a distinct, though sometimes shallow, central furrow throughout, containing a fine carina, its sides obtusely carinate and with variable setigerous punctuation; lateral sulci deep, subequal, the upper pair meeting at base, which is somewhat raised above the plane of the forehead; scrobes deep, oblique, lateral but rather intermediate in character; inferior basal furrow very deep; mentum produced into a sharp prominent point. *Antennæ* with the scape barely reaching eye; the two basal joints of funicle subequal. *Prothorax* broader than long, apex narrower than base, sides distinctly rounded, broadest rather before middle, dorsal anterior margin truncate, ocular lobes feeble. Upper surface convex, set with small rounded remote tubercles (sometimes arranged in four rows on each side), leaving a broad but shallow central furrow containing a distinct carina. Tubercles bare, shiny, each with a depressed pale seta; interstices with uniform brown scaling. *Elytra* ovate in ♀, narrower and oblongo-ovate in ♂, shoulders rounded, sides very little rounded, broadest about middle, apical processes very small in both sexes. Upper surface convex, with regular rows of ocellated punctures; interval 1 with a row of granules, ceasing at the declivity; interval 2 with only a short apical row of granules including a large tubercle at the top of the declivity; intervals 4 and 6 smooth, or at most with one or two isolated granules; 3, 5, and 7 with regular and complete rows of closely-set granules, including a distinctly larger one at the top of the declivity on interval 3, which is nearer the base than the tubercle on 2. Granules (but not the four larger tubercles) bare and shiny, each with a rather long depressed pale seta, the remaining surface covered with small round brown scaling, often variegated with lighter patches. *Legs* with fairly dense light brown scaling on the tibiæ and apical part of femora, the remainder of latter much more sparingly scaled; posterior tarsi narrow, the joints of the same width, 2nd and 3rd subequal in length, 1st rather longer.

Orange River Colony: Bothaville (*Dr. H. Brauns*). Natal: Durban (*C. N. Barker*), Estcourt. Transvaal: Lydenburg. Mashonaland: Umtali (*A. Bodong*).

Type in the Stockholm Museum.

This is probably the commonest species of the genus in Natal, being especially prevalent in the upland districts. The projection of the mentum occurs in all the examples from Natal and the Orange River Colony which I have examined; but I have two specimens from the Transvaal, one from Umtali, and an unlabelled one from Drège's collection in which this is lacking. Without more material it is impossible to say whether this can be regarded as a specific character. It is not present in any of the allied species.

92. H. BINODIS Gyl.

H. binodis Gyl. Schönh. Gen. Curc. i. p. 478 (1833).
H. contortus Gyl. op. c. v. p. 764 (1840).

Long. 12–18, lat. 5½–8 mm.

Head coriaceous, with fairly dense brown scaling, vertex convex, forehead broadly but shallowly excavate; anteocular furrows deep, convergent dorsally. *Rostrum* not separated from head at base, stout, curved and gradually dilated to apex. Upper surface punctured and scaled like the head, with a deep central furrow throughout, containing no carina and edged on each side by a prominent rounded costa; lateral sulci deep, the upper pair much longer than the lower and meeting at base; scrobes deep, lateral and oblique; inferior basal furrow very deep. *Antennæ* with scape just reaching eye; the two basal joints of funicle subequal, or with the second joint slightly longer. *Prothorax* strongly transverse, apex a little narrower than base, sides strongly rounded, broadest about middle, dorsal anterior margin concave, ocular lobes moderate. Upper surface almost plane, fairly closely set with elevated subconical tubercles, leaving a distinct central furrow containing a low abbreviated carina; tubercles bare at apex only and with depressed pale setæ, the interstices with dense brown scaling. *Elytra* oblongo-ovate, narrower in ♂, shoulders prominent, subrectangular, sides subparallel to beyond middle, apical processes rudimentary or absent in both sexes. Upper surface somewhat convex, with regular rows of shallow ocellated punctures; interval 1 with a row of granules vanishing near apex; interval 2 with only a short apical row of small tubercles, that at the top of the declivity being much larger than the others; intervals 3, 5, and 7 with complete rows of small, closely-set, subconical tubercles, the former with a single rather larger one at the top of the declivity, nearer the base than that on 2; 4 and 6 plane and devoid of tubercles; apices only of tubercles bare and with depressed pale setæ, the interspaces with dense brown scaling. *Legs* with uniform dense brown scaling; posterior tarsi narrow, the 3rd joint slightly broader than the others, 2nd and 3rd subequal in length, 1st rather longer.

NATAL: Durban (*C. N. Barker*). CAPE COLONY: Grahamstown (*Rev. J. A. O'Neil*), Algoa Bay (*Dr. Brauns*), Somerset East [S. A. Mus.]. PORT. E. AFRICA: Delagoa Bay (*H. Junod*).

TYPE in the Stockholm Museum.

93. H. FALLAX Fåhr.

H. fallax Fåhr. Öfv. K. Vet.-Ak. Förh. p. 208 (1871).

Long. 15–16, lat. 6–7 mm.

Head closely but faintly punctured and densely squamose, forehead broadly but shallowly excavate and with a short deep stria near base of rostrum; anteocular furrows deep and distinctly convergent above. *Rostrum* not incised dorsally at base, about as long as head and prothorax, slightly curved. Upper surface

closely squamose, with a deep and continuous central furrow containing no carina; lateral sulci rather shallow, the upper pair much longer and meeting at base, where there is a low callus before the eye; scrobes lateral and oblique; inferior basal furrow present. *Antennæ* with scape just reaching eye; the second joint of funicle longer than first. *Prothorax* as long as broad in ♂, a little broader in ♀, apex narrower than base, sides not much rounded, broadest about middle, anterior margin truncate, ocular lobes moderate. Upper surface almost plane, fairly closely set with small rounded tubercles, leaving a shallow central furrow containing a low carina; apices only of tubercles bare, each with a depressed dark seta, interstices with close brown scaling. *Elytra* oblongo-ovate, much broader in ♀, shoulders roundedly prominent, broader than prothorax in ♂, much more so in ♀, sides subparallel to beyond middle, apical processes very small and blunt in both sexes. Upper surface slightly convex, with regular rows of distinct deep punctures; interval 1 with a row of depressed setæ in lieu of granules; interval 2 with only a short apical row of small granular tubercles, including one on the declivity much larger than the rest; intervals 3, 5, and 7 each with a single complete and regular row of small closely-set tubercles, interval 3 with a single one at the top of the declivity larger than the others; intervals 4 and 6 smooth; the whole surface, including apices of tubercles, densely covered with uniform brown scaling, the scales being minute and round, tubercles with dark depressed apical setæ. *Legs* with dense brown scaling variegated with small black spots; posterior tarsi with joints of the same width, 2nd and 3rd subequal in length, 1st a little longer.

South Africa.

Type in the Stockholm Museum.

I have seen very few specimens of this insect, none of which were labelled; most likely it comes from the Transvaal. In general appearance it is extremely like *affinis* Fåhr., but its rostrum lacks the central carina and quite resembles that of *binodis* Gyl. From this latter its longer and more parallel-sided elytra and much narrower thorax will distinguish it; moreover the punctures on the elytra are smaller and slightly further apart, thus causing a much smoother appearance than in either of its allies.

94. †H. quadrinodis Fåhr.

H. quadrinodis Fåhr. Schönh. Gen. Curc. v. p. 765 (1840).

Long. 10–11, lat. 5–6 mm.

Head closely punctured and with thin scaling, vertex convex, forehead strongly retuse and flattened; anteocular furrows very deep, convergent above. *Rostrum* not separated from head at base, as long as head and prothorax, thick, distinctly curved and slightly dilated towards apex. Upper surface densely squamose, with a broad very shallow central furrow and two faintly granulate carinæ on each side of it; lateral sulci deep, subequal, the upper

pair uniting at base; scrobes deep, lateral and oblique; inferior basal furrow very deep. *Antennæ* with scape not quite reaching eye; the two basal joints of funicle subequal. *Prothorax* subglobose, transverse, apex almost broader than base, sides very strongly rounded, broadest about middle, dorsal anterior margin concave, ocular lobes well developed. Upper surface convex, fairly closely set with low rounded tubercles, leaving a distinct central furrow containing an abbreviated carina; apices of tubercles bare and with depressed pale setæ, the interstices with dense brown scaling. *Elytra* oblongo-ovate, subquadrate in ♀, much narrower in ♂, posterior declivity very steep, shoulders roundedly prominent, sides slightly rounded, broadest at middle, apical processes absent in ♂, obsolescent in ♀. Upper surface convex, with regular rows of deep, subreticulate foveæ; the intervals very narrow, 3, 5, and 7 strongly carinate and with rows of minute depressed granules, the former terminating at the top of the declivity with a sharply prominent tubercle; interval 2 with only a short apical row of small tubercles and a much larger one at the top of the declivity, behind that on interval 3; interval 1 with a row of depressed pale setæ; 4 and 6 with at most one or two isolated granules; granules bare at apex and with very short depressed pale setæ, the interspaces with dense uniform brown scaling. *Legs* with similar scaling; posterior tarsi short, the three joints subequal in length and breadth.

Cape Colony: Grahamstown and Uitenhage (*Rev. J. A. O'Neil*). Natal: Upper Tongaat R. (*C. N. Barker*).

Type in the Stockholm Museum.

95. H. braunsi Mshl. (Plate III. fig. 6.)

H. braunsi Mshl. l. c. p. 451 (1902).

Long. 11, lat. 5 mm.

Head convex on vertex, forehead flattened and with a deep impression on each side, punctuation close and regular, but mostly hidden by fulvous scaling; anteocular furrows deep, convergent above and only separated by a narrow costa. *Rostrum* not incised at base, nearly as long as head and prothorax, slightly curved and moderately dilated near apex. Upper surface with a broad and distinct central furrow throughout, with its edges carinate and bearing a regular row of depressed paler setæ, the punctuation hidden by uniform dense brown scaling; lateral sulci broad and deep, subequal, the upper pair meeting at base, which is much raised above the level of forehead; scrobes deep, sublateral; inferior basal furrow deep. *Antennæ* with scape not reaching eye; joints 1 and 2 of funicle subequal. *Prothorax* a trifle broader than long, apex and base of equal width, sides strongly rounded, broadest before middle, dorsal anterior margin truncate, ocular lobes well developed. Upper surface convex, with small rounded widely separated tubercles, leaving a broad but shallow central furrow containing a distinct carina; tubercles bare, with depressed pale apical setæ, the interstices with dense brown squamosity.

Elytra ovate, shoulders rounded, sides very little dilated, broadest before middle, apical processes very small, tuberculiform and contiguous in ♀, absent in ♂. Upper surface convex, with regular rows of large reticulate foveæ without intervening granules; interval 1 without granules but with a single row of depressed setæ; interval 2 with only a short apical row of three or four very small tubercles, that at the summit of the declivity much larger than the rest; interval 3 with a costa to beyond middle and continued to apex in the form of small separate tubercles, the largest being at the top of the declivity (in a varietal form this costa is replaced by a row of small separated tubercles); intervals 4 and 6 smooth or with a few isolated tubercles; 5 and 7 with complete rows of small conical remote tubercles; scaling dense, uniform brown, the tubercles bare at apex and each with a thick whitish depressed seta. *Legs* thin, covered with dense brown scaling and scattered white setæ; posterior tarsi narrow, the three basal joints of equal width, 2nd and 3rd equal in length, 1st rather longer.

Orange River Colony: Bothaville (*Dr. H. Brauns*).

Type in the British Museum.

96. H. errans Mshl. (Plate III. fig. 5.)

H. errans Mshl. l. c. p. 443 (1902).

Long. 12, lat. 6 mm.

Head densely covered with brown squamæ, vertex convex, forehead flattened and with a short central stria; anteocular furrows distinct in their upper half only. *Rostrum* not incised at base, about as long as prothorax only, stout, not much curved, dilated to apex. Upper surface almost plane, with a distinct carina abbreviated in front, rugosely punctured, with dense scaling and scattered setæ; lateral sulci distinct, the upper pair rather longer and broader, and meeting at the base which is a little elevated; scrobes shallow, lateral and oblique; inferior basal furrow deep. *Antennæ* with scape just reaching eye; the two basal joints of funicle subequal. *Prothorax* distinctly transverse, apex a little narrower than base, sides strongly rounded, broadest about middle, dorsal anterior margin truncate, ocular lobes moderate. Upper surface convex, closely set with small granular tubercles leaving a very narrow ill-defined central furrow containing no carina; apices of tubercles bare, shiny, each with a depressed seta, the interstices with dense brown scaling and three narrow whitish lines. *Elytra* short ovate, sides moderately rounded, broadest about middle, shoulders rounded, apical processes very short but acute. Upper surface convex, with regular rows of deep punctures, intervening granules sometimes present but hidden by the scaling; intervals unevenly costate, 3, 5, and 7 being more raised than the others and with regular and complete rows of low granules; interval 1 has a similar complete row, but 2, 4, and 6 are very variable, bearing anything from a complete row to none at all; granules shiny and each with a depressed pale seta; scaling dense, variegated brown and grey. *Legs* with sparse pale scaling which

is more dense towards the apex of femora; posterior tarsi with the joints of about the same width, 2nd and 3rd subequal in length, 1st longer.

NATAL: Estcourt.

TYPE in the British Museum.

97. H. SQUALIDUS Gyl.

H. squalidus Gyl. Schh. Gen. Curc. i. p. 490 (1833).

Long. 15, lat. 6½ mm.

Head convex, closely punctured, forehead flattened and with a faint central carina; anteocular furrows deep. *Rostrum* not incised at base, slightly shorter than prothorax, thick, strongly curved and dilated to apex. Upper surface rugosely punctured, with a deep and broad central furrow containing no carina; lateral sulci deep, the lower pair much shorter and subtriangular, the upper broad and uniting at base; scrobes directed beneath base of rostrum; inferior basal furrow shallow. *Antennæ* with scape just reaching eye; the two basal joints of funicle subequal. *Prothorax* nearly as long as broad, apex scarcely narrower than base, sides moderately rounded, broadest about middle, dorsal apical margin truncate, ocular lobes distinct. Upper surface convex, closely set with small elevated tubercles, leaving a narrow central furrow containing a strong carina; apices of tubercles bare and each with a depressed seta, interstices and sides of tubercles with dense brown scaling. *Elytra* ovate, shoulders rounded, sides slightly rounded, broadest about middle, apical processes short but acute, in ♀ only. Upper surface convex, distinctly and regularly sulcate, the sulci containing very faint punctures separated by distinct granules; intervals evenly raised and bearing regular single rows of closely-set subconical granules, except interval 1, on which the granules are much smaller and disappear behind middle; the granules become a little larger and more conical towards apex, especially those on interval 2, their apices only are bare and they have short pale depressed setæ, the remainder of the surface being densely covered with brown scaling. *Legs* with uniform scaling; posterior tarsi with joints of the same width, 2nd and 3rd of equal length, 1st a little longer.

CAPE COLONY: Grahamstown (*Rev. J. A. O'Neil*).

TYPE in the Stockholm Museum.

98. †H. MODESTUS, sp. nov.

Long. 16, lat. 7 mm.

Head obscurely punctured and with sparse fulvous scaling, convex on vertex, forehead flattened, but without fovea or carina; anteocular furrows deep. *Rostrum* not incised at base, as long as prothorax, thick, not much curved and strongly dilated to apex. Upper surface closely punctured and sparsely squamose, elevated and with a deep central furrow throughout, containing a faint carina and having a strong costa on either side; lateral sulci deep, the upper pair longer and uniting at base, the lower pair

subtriangular; scrobes deep, directed beneath base of rostrum; inferior basal furrow deep. *Antennæ* with scape just reaching eye; the second joint of funicle longer than the first. *Prothorax* transverse, apex and base of equal width, sides very little rounded, broadest about middle, dorsal anterior margin truncate, ocular lobes feeble. Upper surface convex, closely set with large rounded granules, leaving a central furrow containing a short but distinct carina; granules bare, with depressed pale setæ, the interstices with dense brown scaling. *Elytra* oblongo-ovate, shoulders roundedly prominent, sides scarcely ampliated, broadest about middle, apical processes in ♀ short but acute. Upper surface convex, with shallow sulci containing rows of indistinct punctures separated by low granules; intervals evenly raised, each having a single complete row of rounded granules, except interval 3, in which the row is more or less duplicated; granules bare, with depressed pale setæ, the interspaces with moderately dense uniform brown scaling. *Legs* with thin pale setæ and a slight ring of pale scaling near apex of femora; posterior tarsi with the joints of about the same width, 2nd and 3rd subequal in length, 1st longer.

TRANSVAAL (*Brady*).

TYPE in the South African Museum.

This species is most nearly allied to *H. squalidus* Gyl., but the rostrum is much longer and thinner and not nearly so strongly curved as in that species, the antennæ are more elongate, the prothorax is distinctly broader, the tubercles are more closely set, and the ocular lobes are much less developed.

99. H. GRANATUS Gyl.

H. granatus Gyl. Schh. Gen. Curc. v. p. 769 (1840).

Long. 16½–17, lat. 8 mm.

Head convex, with close shallow punctuation, forehead with a very deep and broad excavation continued on to base of rostrum; anteocular furrows deep in their upper half but vanishing below. *Rostrum* not separated from head by a deep dorsal incision, as long as prothorax only, slightly curved and strongly dilated to apex. Upper surface with a deep narrow central furrow, edged by a broad rounded and finely punctured costa; lateral sulci deep and distinct, the lower ones subtriangular, the upper pair narrower and meeting at base; scrobes directed beneath rostrum; inferior basal furrow absent. *Antennæ* with scape just reaching eye; the second joint of funicle a little longer than first. *Prothorax* a little broader than long, apex narrower than base, sides slightly rounded, broadest about middle, dorsal anterior margin truncate, ocular lobes not pronounced. Upper surface almost plane, fairly closely set with depressed tubercles, leaving a narrow central furrow containing a broad flattened carina; tubercles with very short depressed setæ. *Elytra* oblongo-ovate, shoulders prominent, sides scarcely rounded, broadest about middle, apical processes very short. Upper surface rather convex, with rows of very faint punctures and occasional intervening granules; intervals with

rows of separate rounded tubercles, which do not increase in size towards apex; the rows on intervals 2, 4, and 6 are often more or less incomplete, especially towards base; tubercles bare, with short depressed dark setæ; scaling very sparse and minute. *Legs* with scattered short pale setæ; posterior tarsi with the three joints subequal in length, the third rather broader than the other two.

Cape Colony.

100. H. partitus Gyl.

H. partitus Gyl. Schh. Gen. Curc. i. p. 481 (1833).

Long. 13, lat. 5½ mm.

Head convex, closely and distinctly punctured throughout; forehead with a broad and deep central impression continued on to base of rostrum; anteocular furrows rather shallow, obsolete in lower half. *Rostrum* not dorsally incised at base, as long as prothorax only, scarcely curved. Upper surface with a deep but narrow central furrow, the adjoining costæ closely punctured, broad and somewhat flattened; lateral sulci deep and distinct, the lower subtriangular, the upper pair narrow and uniting at base; scrobes slightly curved, lateral, though approaching rather to the subrostral type; inferior basal furrow absent. *Antennæ* with scape just reaching eye; second joint of funicle a little longer than first. *Prothorax* rather transverse, apex equal to base, sides slightly rounded, broadest about middle, dorsal anterior margin truncate, ocular lobes feeble. Upper surface almost plane, closely set with small low tubercles, leaving a narrow central furrow containing a faint carina; tubercles with very short pale depressed setæ. *Elytra* oblongo-ovate, shoulders prominent, sides scarcely rounded, broadest about middle, apical processes very small and contiguous. Upper surface rather convex, with shallow sulci containing rows of granules; in the sulci near the suture these granules often unite with the intervals so as to form subreticulate foveæ; intervals all with single rows of small low elongate tubercles, becoming rather smaller towards apex; tubercles bare, with very short, pale, depressed setæ; scaling very small and scattered. *Legs* with sparse pale setæ; posterior tarsi with the joints subequal in length, the third a little broader than the others.

Cape Colony.

Type in the Stockholm Museum.

Nearly allied to *granatus* Gyl., though having rather a different aspect, owing to its smaller size, narrower build, and smaller and closer tuberculation. Moreover the costa between the lateral sulci on the rostrum is continued quite straight up the forehead, whereas in *granatus* it is distinctly sinuate before the eye; and the scrobes are lateral instead of distinctly subrostral.

101. H. permixtus, sp. nov. (Plate III. fig. 8.)

Long. 11, lat. 5 mm.

Head convex, rugosely punctured, and with dense brown scaling,

forehead with a short central stria near base of rostrum; anteocular furrows very deep. *Rostrum* not incised dorsally at base, as long as prothorax only, gradually curved. Upper surface plane, coarsely punctured, and with a low narrow undulating central carina; lateral sulci distinct, the upper pair longer and meeting at base, which is somewhat higher than forehead; scrobes directed beneath base of rostrum; inferior basal furrow present. *Antennæ* with scape just reaching eye; first joint of funicle a little longer than second. *Prothorax* transverse, apex narrower than base, sides rounded, broadest before middle, anterior margin truncate, ocular lobes very feeble. Upper surface closely set with small granular tubercles, leaving a narrow central furrow containing no carina; tubercles bare, each with a depressed pale seta, interstices with brown scaling. *Elytra* ovate, shoulders roundedly prominent, sides rounded, broadest rather before middle, apical processes very short and blunt, in ♀ only. Upper surface convex, striæ with rows of shallow ocellated punctures often separated by small granules; intervals all similar, each with a regular row of distinct closely-set granules, which are shiny and each with a depressed pale seta; interspaces with dense brown scaling, each elytron having a paler patch at the top of the declivity on intervals 2, 3, and 4. *Legs* with scattered pale scaling, forming a denser ring near the apex of femora; posterior tarsi with the 3rd joint rather broader than the others, 2nd and 3rd subequal in length, 1st rather longer.

TRANSVAAL.

TYPE in the British Museum.

102. †H. ALBICANS Gyl.

H. albicans Gyl. Schh. Gen. Curc. v. p. 770 (1840).

Long. 11, lat. 5½ mm.

Head convex, with close shallow punctuation and dense pale brown scaling throughout, forehead with a very short and low central carina; anteocular furrows narrow and not very deep, obsolete in their lower half, but closely convergent above. *Rostrum* not cut off from head by a basal incision, short, thick and angulated, as long as prothorax only, gradually dilated to apex. Upper surface almost plane, rugosely punctured, and with a distinct narrow, smooth, central carina; lateral sulci deep, the upper pair rather longer, broader, and meeting at base, which is much raised above the plane of forehead; scrobes lateral, broad and shallow; inferior basal furrow very deep. *Antennæ* with scape just reaching eye; the two basal joints of funicle subequal. *Prothorax* transverse, apex narrower than base, sides strongly rounded, broadest about middle, anterior margin subtruncate, ocular lobes well developed. Upper surface convex, closely set with large rounded granules, leaving a scarcely distinguishable central furrow without any carina; granules bare and with depressed pale setæ, the interstices with dense light brown scaling. *Elytra* ovate, sides rounded, broadest about middle, shoulders sloping, apical processes

absent. Upper surface convex, the striæ with rows of ocellated punctures; intervals even, subcostate, and each with a row of small low rounded and widely separated tubercles, which are bare and shiny, each having a depressed dark seta; the interspaces densely and evenly covered with uniform light brown scaling. *Legs* with moderately dense pale scaling and setæ, but noticeably thinner on the basal half of femora; posterior tarsi with the 2nd joint a trifle narrower than the others, 1st longer than 3rd, and 3rd than 2nd.

NATAL: Estcourt.

103. †H. CAPICOLA Gyl.

H. capicola Gyl. Schh. Gen. Curc. v. p. 771 (1840).

Long. 12, lat. 4 mm.

Head closely and strongly punctured, convex on vertex, forehead slightly flattened and rugose; eyes prominent; anteocular furrows obsolete. *Rostrum* not incised at base, about as long as head and prothorax, gently curved, comparatively slender, gently dilated from middle to apex. Upper surface with five narrow smooth carinæ of about equal height and length, the three central ones converging slightly towards base, the sulci closely punctured and filled with pale scaling; scrobes entirely lateral and parallel to the long axis of the rostrum; inferior basal furrow absent. *Antennæ* slender, elongate; scape just reaching eye; second joint of funicle much longer than first. *Prothorax* as long as broad, apex and base of equal width, sides very little rounded, broadest rather before middle, anterior margin truncate, ocular lobes well developed. Upper surface slightly convex, unevenly set with small granular tubercles, leaving an ill-defined central furrow containing no carina; tubercles bare, each with a short suberect black seta, interstices with small round white scales having an opalescent reflection and arranged so as to form five ill-defined lines. *Elytra* very narrow and elongate, somewhat acuminate apically, shoulders sloping, sides gradually rounded, broadest before middle, apical prominences absent. Upper surface convex, with regular rows of large shallow punctures usually separated by small granules; the intervals all similar, with rows of low rounded distant tubercles each bearing a long erect black seta; the spaces between the tubercles are occupied by round spots of white scales having an opalescent reflection, thus forming regular rows of spots on each interval. *Legs* elongate, with sparse pale scaling, the femora more strongly clavate than usual; posterior tarsi broad, the 3rd joint shorter and broader than the other two, 1st very elongate, much longer and slightly broader than 2nd.

CAPE COLONY.

TYPE in the Oxford Museum; the type of Gyllenhal's var. *β* is at Stockholm.

A rare species. I have seen only four examples, all of which must have been captured more than sixty years ago. It may be easily recognised among its allies by its very elongate form and distinctive coloration.

104. H. CINEREUS, sp. nov. (Plate III. fig. 9.)

Long. 11, lat. 4¼ mm.

Head with scattered grey scaling and diffuse faint punctuation, vertex convex, forehead slightly flattened and without fovea or carina; anteocular furrows broad but shallow, disappearing inferiorly. *Rostrum* not incised at base, as long as prothorax only, comparatively thin, slightly curved and dilated near apex only. Upper surface slightly convex, with five narrow carinæ of equal height, the sulci being rugosely punctured and having sparse white scaling; lateral sulci distinct, the upper ones longer and uniting at base; scrobes entirely lateral, straight and very little oblique; inferior basal furrow deep. *Antennæ* elongate, piceous and finely pubescent; scape barely reaching eye; second joint of funicle much longer than first. *Prothorax* slightly transverse, apex narrower than base, sides moderately rounded, broadest about middle, dorsal anterior margin truncate, ocular lobes prominent. Upper surface slightly convex, moderately closely set with small granular tubercles, leaving a narrow central furrow without a carina; apices of tubercles bare, shiny, and with a depressed white seta, interstices with dense grey scaling. *Elytra* oblongo-ovate, elongate, shoulders sloping, sides very little rounded, broadest about middle, apical processes absent. Upper surface convex, with rows of small punctures, often with intervening granules, intervals with more or less continuous rows of small granular tubercles, which are subequal throughout; intervals 1, 3, 5, and 7 have the tubercles more numerous and nearer together than 2, 4, and 6; tubercles as on prothorax, the interstices with fairly dense large round grey scales. *Legs* with scattered pale setæ and a ring of white scales near apex of femora; intermediate tibiæ of ♂ strongly incurved at apex; posterior tarsi with the 2nd joint narrower than the others, 2nd and 3rd subequal in length, 1st longer.

CAPE COLONY.

TYPE in the British Museum.

Somewhat resembling *seriegranosus* Gyl. in general facies and the tarsal structure, but that species has the scape extending beyond the anterior margin of the eyes, which are nearly twice as large as in *cinereus*, and the scales on the elytra are very minute. The nearest ally to *cinereus*, however, is *capicola* Gyl.

105. H. SETIFERUS Gyl.

H. setiferus Gyl. Schh. Gen. Curc. v. p. 770 (1840)

Long. 12, lat. 5½ mm.

Head convex, coarsely and closely punctured, forehead flattened, anteocular furrows absent. *Rostrum* not incised dorsally at base, as long as prothorax only, not very thick and distinctly curved. Upper surface convex, with five narrow but prominent carinæ, the three middle ones parallel throughout, the interspaces rugosely punctured and with fine scaling; lateral sulci distinct, about equal in length, the upper pair coalescing at base; scrobes entirely

lateral and slightly curved; inferior basal furrow absent. *Antennæ* with scape just reaching eye; second joint of funicle much longer than first. *Prothorax* a little broader than long, apex almost as broad as base, sides moderately rounded, broadest about middle, dorsal anterior margin truncate, ocular lobes well developed; upper surface slightly convex, closely set with erect granules, leaving an indistinct central furrow, sometimes containing a faint carina; granules with short suberect pale setæ, interstices with round yellowish scaling. *Elytra* ovate, somewhat acuminate apically in ♀, shoulders roundedly prominent, sides distinctly rounded, broadest about middle, apical processes absent. Upper surface with shallow sulci containing rows of indistinct punctures separated by distinct granules; intervals all similar, each bearing a somewhat irregular, and occasionally duplicated, row of granules, each with a short suberect dark seta; scales brown, minute, and thinly scattered. *Legs* with pale setiform scales; posterior tarsi with the 2nd joint rather narrower than the others, 2nd and 3rd subequal in length, 1st longer.

Cape Colony.

106. H. pilifer Fåhr.

H. pilifer Fåhr. Öfv. K. Vet.-Ak. Förh. 1871, p. 210.

Long. 10–12, lat. $4\frac{1}{4}$–$5\frac{1}{2}$ mm.

Head convex, closely but shallowly punctured, with fine long setæ, mostly depressed, but some erect; forehead slightly retuse, without fovea or carina; anteocular furrows obsolete. *Rostrum* as long as head and prothorax, not incised at base, very little curved and distinctly dilated to apex. Upper surface convex, with five narrow smooth carinæ, the centre one being the highest; lateral sulci distinct, the upper pair rather longer and meeting at base, which is higher than the level of forehead; scrobes lateral and shallow; inferior basal furrow absent. *Antennæ* with sparse pale setæ; scape just reaching eye; the two basal joints of funicle subequal. *Prothorax* as long as broad, apex and base of equal width, sides distinctly rounded, broadest at middle, anterior margin truncate, ocular lobes moderate. Upper surface convex, closely set with low granular tubercles, leaving a very narrow and indefinite central furrow without any carina; tubercles bare, each with a long erect dark seta, interstices with dense scaling which is brown with three narrow paler lines. *Elytra* ovate, much broader in ♀, shoulders sloping, sides distinctly rounded, broadest about middle, apical processes absent. Upper surface rather convex, the striæ with small punctures separated by granules (both normally hidden beneath the scaling); interstices all even, almost plane, each with a row of very small granules showing through the scaling and bearing long erect black setæ; the granules on the inflexed margins bear short depressed pale setæ; scaling small, dense, almost uniform earthy brown, usually with a small rounded white spot on interval 3 behind middle. *Legs* rather thinly clothed with long white setæ; posterior tarsi

with the 3rd joint rather broader than the others, 2nd and 3rd subequal in length, 1st rather longer.

CAPE COLONY: Burghersdorp.

TYPE in the Stockholm Museum.

107. H. LATICEPS Mshl. (Plate III. fig. 10.)

H. laticeps Mshl. l. c. p. 453 (1902).

Long. 10, lat. 4 mm.

Head densely covered with brown scaling, convex on vertex; forehead broad, flattened and with a short central carina, eyes prominent; anteocular furrows short and narrow but distinct. *Rostrum* not incised at base, short and thick, about as long as prothorax only, scarcely curved. Upper surface convex, closely punctured and densely squamose, with five thin undulating carinæ, which are black and shiny, the three central ones being of the same height; lateral sulci distinct, the upper pair much broader and converging at base, which is evidently raised; scrobes lateral but oblique; inferior transverse basal furrow absent. *Antennæ* piceous, finely pubescent; scape just reaching anterior margin of eye; the two basal joints of funicle subequal. *Prothorax* transverse, its length about equal to the width at base, which is scarcely broader than apex, dorsal anterior margin deeply concave, sides moderately rounded, broadest about middle, ocular lobes very slight. Upper surface convex, closely set with rounded granules, leaving a narrow central furrow without any carina; granules bare, each with a subdepressed seta, the interstices with brown scaling and a paler central line. *Elytra* elongato-ovate, rather acuminate apically in ♀, shoulders rounded, sides scarcely ampliated, broadest about middle, apical processes absent. Upper surface almost plane on disk, faintly sulcate, the sulci containing small shallow punctures which are quite hidden by the scaling; all intervals similar, having single rows of minute black granules bearing subdepressed setæ; scaling dense, uniform grey-brown. *Legs* with long whitish pubescence; posterior tarsi narrow, setose, the 2nd joint rather narrower than the 1st and 3rd, 2nd and 3rd subequal in length, 1st longer.

CAPE COLONY: Port Elizabeth (*Dr. H. Brauns*).

TYPE in the British Museum.

In my original description (*loc. cit.*) of this species I compared it with *arenarius* Fåhr. I had not then seen Fåhræus' type, and the insect which I referred to his species is really *permixtus* Mshl.

108. H. GUNNINGI Mshl. (Plate IV. fig. 2.)

H. gunningi Mshl. l. c. p. 442 (1902).

Long. 19–20, lat. 7½–8 mm.

Head closely punctured and densely squamose, convex on vertex, forehead flattened and with a central carina, eyes rather prominent; anteocular furrows obsolescent. *Rostrum* not incised at base, scarcely as long as prothorax alone, very little curved and

dilated to apex. Upper surface with a shallow central furrow throughout containing a narrow shiny carina; lateral sulci well-marked, the upper pair uniting at base, which is not much raised; costæ between the sulci obtuse, densely squamose, and each with a single row of shiny black granules; scrobes shallow, lateral and oblique; inferior basal furrow absent. *Antennæ* with scape just reaching eye; the two basal joints of funicle subequal. *Prothorax* as long as broad, apex and base of equal width, sides rounded, broadest about middle, a faint transverse impression just behind apex, dorsal anterior margin slightly sinuate, ocular lobes feebly developed. Upper surface convex, closely set with small granular tubercles, leaving a narrow central furrow without a carina; tubercles black, shiny, each with a depressed seta, the interstices with brownish-grey scaling and three narrow paler lines. *Elytra* elongate, strongly acuminate towards apex in ♀, scarcely so in ♂, shoulders sloping, sides rounded, broadest rather behind middle, apical processes absent. Upper surface not very convex, with regular broad shallow sulci containing single rows of small granules; intervals of equal height, subcarinate, with somewhat irregular, and often duplicated, rows of small closely-set granules; granules bare, each with a depressed seta; scaling dense, fulvous, variegated with small patches of dark brown and grey. *Legs* with thin grey pubescence; posterior tarsi with the 2nd joint narrower than the 1st and 3rd, but about as long as the latter.

Transvaal: Lydenburg (*Dr. J. W. B. Gunning*).

Type in the British Museum.

This species, except for the depressed setæ, has very much the appearance of a large *pilifer*; its only near ally, however, is *constrictus* Gyl., from which the characters given in the key will sufficiently distinguish it.

109. †H. constrictus Gyl.

H. constrictus Gyl. Schh. Gen. Curc. v. p. 790 (1840).

Long. 22, lat. 9 mm.

Head closely and strongly punctured, with fulvous scaling, vertex convex, forehead flattened and with a low central carina; anteocular furrows obsolete; eyes rather prominent. *Rostrum* short and thick, about as long as prothorax alone, scarcely curved, with the base very strongly raised above the plane of forehead, but not separated from it by a real incision. Upper surface very convex, with five strong carinæ, the central one being narrow, smooth, and much raised above the others, which are broader and rugosely punctured or granulate; lateral sulci very deep, the upper pair longer and uniting at base, the lower pair subtriangular; scrobes shallow, entirely lateral; inferior basal furrow absent. *Antennæ* with scape reaching eye; the two basal joints of funicle subequal. *Prothorax* distinctly transverse, apex narrower than base, sides strongly rounded, broadest about middle, a shallow transverse impression just behind apex, anterior [illegible] faintly sinuated in the middle, [illegible]

surface convex, closely set with small flattened granular tubercles, leaving a narrow shallow central furrow without any carina; tubercles black, shiny, each with a depressed seta, interstices with dense brown scaling. *Elytra* (♀) ovate, acuminate posteriorly, shoulders sloping, sides distinctly rounded, broadest rather before middle, apical processes absent. Upper surface almost plane on disk, with regular shallow sulci, containing indistinct punctures separated by small granules, both disappearing behind middle and normally hidden by the uniform dense brown scaling; intervals all similar, slightly convex, with irregular rows of faint granules which disappear towards apex, the granules bearing depressed pale setæ which are continued in rows where the former have disappeared. *Legs* with scattered brownish setæ; posterior tarsi broad, spongy, and with the joints of equal width, the 3rd longer than 2nd and almost as long as 1st.

"CAFFRARIA."

TYPE in the Stockholm Museum.

Schönherr placed this species in the section of the genus having the "*rostrum ad basin quasi abscissum*," but although the elevation of the base of the rostrum gives it somewhat this appearance, its structural affinities are rather with those species with which I have associated it. In the group typified by *verrucosus* L. this incision separating the head from the rostrum is caused by the dorsal union of the deep anteocular furrows; this is not the case with *constrictus*, in which those furrows are entirely absent.

110. H. INCISIROSTRIS Mshl. (Plate IV. fig. 3.)

H. incisirostris Mshl. l. c. p. 409 (1902).

Long. 24, lat. 10 mm.

Head convex, closely and finely punctured, forehead flattened and with a very faint central stria; anteocular furrows very deep and distinct. *Rostrum* not incised at base, as long as head and prothorax, stout, moderately curved, dilated apically, the genæ being produced into a sharp prominent point. Upper surface divided into two portions by a broad and deep transverse incision at about one-third from base; the whole of the basal portion is strongly raised so as to form a broad thick rounded horn, which is distinctly punctured throughout; the upper surface of the anterior portion is broadly excavate, with its edges strongly carinate, and punctured only along the sides and base; upper lateral sulci deep, but narrow and short, ascending the sides of the horn and meeting behind it, but not continued on to the anterior portion; lateral sulci very broad and deep and continued from base to the middle of the anterior portion; scrobes directed beneath base of rostrum; inferior transverse basal furrow absent. *Antennæ* with scape just reaching eye; the two basal joints of funicle subequal. *Prothorax* rather broader than long, the length greater than the width at base, which is a little broader than the apex, sides strongly rounded, broadest about middle, dorsal

anterior margin slightly convex, ocular lobes almost obsolete. Upper surface almost plane, closely covered with small rounded tubercles, leaving a very indistinct central furrow containing a short but well-marked carina; a distinct transverse dorsal impression just behind apex; tubercles bare, each with a pale depressed seta, the interstices with dense brown scaling. *Elytra* elongato-ovate, shoulders sloping, sides slightly rounded, broadest about middle, the posterior declivity laterally compressed, so that the space between the second intervals on each elytron is distinctly raised, apical processes moderately long and sharp in both sexes. Upper surface convex, faintly striate, the striæ with indistinct punctures separated by small granules; intervals even and with regular rows of granules except the first, which is smooth throughout, and the lateral compressed portion of the declivity is also almost free from granules; scaling rather thin, variegated brown, with the inflexed margin and a broad sutural stripe much paler; setæ pale, very small and much depressed. *Legs* long, rather slender, with sparse pale setæ; posterior tarsi broad, the joints of about the same width, 2nd and 3rd subequal in length, 1st a little longer.

Cape Colony.

Type in the British Museum.

A striking and quite isolated species, which may be readily distinguished from all its congeners by the peculiar structure of the rostrum—especially in the character of the basal horn, the transverse dorsal incision, and the acuminate genæ.

111. H. dregei Gyl.

H. dregei Gyl. Schh. Gen. Curc. v. p. 749 (1840); Labr. & Imh. Gen. Curc. ii. no. 34 (1845).

Long. 22–25, lat. 8–10 mm.

Head convex on vertex, forehead flattened and without fovea or carina, punctuation indistinct; anteocular furrows deep. *Rostrum* not cut off from head by a deep dorsal incision, as long as head and prothorax, strongly curved. Upper surface with a stout basal tubercle, which is roundedly bifid at apex, broadly excavate anteriorly, the edges there raised and dilated, without a central carina and with shallow punctuation along the edges only; lateral sulci uniting at base, the upper ones narrow and rather faint, the lower longer and deeper; scrobes directed beneath base of rostrum; inferior basal furrow distinct. *Antennæ* with sparse pale setæ; scape not nearly reaching eye; the two basal joints of funicle subequal. *Prothorax* as long as broad, apex a little narrower than base, sides rounded, broadest about middle, apical margin convex, ocular lobes strongly developed. Upper surface almost plane, fairly closely set with large subconical tubercles, leaving a narrow central furrow containing a short but distinct carina; tubercles bare, shiny, each with a depressed dark seta; the anterior half of central furrow, a broad lateral stripe, and the whole of prosternum with dense large white scaling. *Elytra* oblong, sides subparallel in ♂, slightly rounded in ♀, shoulders

distinct and rounded, apical processes shortly acuminate in both sexes; just within the apex of each elytron a very large prominence formed by the agglomeration of about a dozen tubercles. Upper surface convex, with rows of shallow and ill-defined punctures separated by small granules; interval 1 with a row of granules disappearing behind middle; intervals 2 and 3 with rows of small closely-set subconical tubercles as far as the summit of the declivity, beyond this with 3 or 4 much larger and sharper tubercles, which are subcristate on interval 2; intervals 4 and 6 with only a very few small tubercles about middle; 5 and 7 with rows of small conical tubercles as far as declivity only; tubercles with depressed dark setæ; colour black, bare, except for several large irregular patches of round white scales. *Abdomen* with a lateral row of rounded impressions on each segment; ♀ with two sharp processes on the posterior margin of the penultimate segment—resembling those in *abruptecostatus* Gyl. *Legs* with dense white scaling and setæ; posterior tarsi with the three joints subequal in length and breadth.

CAPE COLONY: Tulbagh, Ceres. NAMAQUALAND: O'okiep (*L. Péringuey*).

TYPE in the Stockholm Museum.

A very distinct species, and in spite of its wide range it appears to be very uncommon.

112. H. BRACHYCEROIDES Mshl. (Plate IV. fig. 1.)

H. brachyceroides Mshl. l. c. p. 415 (1902).

Long. 22, lat. 9 mm.

Head convex, without any central fovea or carina, the punctuation hidden by very dense brown scaling; anteocular furrows distinct. *Rostrum* not incised at base, as long as head and prothorax, strongly curved and dilated apically; at base a large stout double horn the apices of which are obtuse and divergent. Upper surface with a broad central furrow throughout and thickly covered with large greyish scales; lateral sulci not uniting at base, of about equal length, broad and distinct, coarsely punctured and filled with scales, the interval between them narrowly carinate; scrobes directed beneath base of rostrum; inferior basal furrow very deep. *Antennæ* with scape not reaching eye; first and second joints of funicle subequal. *Prothorax* as long as broad, apex narrower than base, sides very little rounded, broadest about middle, dorsal anterior margin convex, ocular lobes very strongly developed. Upper surface convex, irregularly set with conical tubercles, leaving a broad central furrow containing a short but strong carina; apices of tubercles bare and with depressed dark setæ, the interstices with dense variegated scaling. *Elytra* oblongo-ovate, shoulders prominent, sides subparallel for three-fourths of the length, apical processes very short and obtuse in both sexes. Upper surface convex, with regular rows of shallow foveolæ; interval 1 entirely devoid of granules or tubercles; interval 6 with a more or less abbreviated row of

small conical tubercles, sometimes wanting; the remaining intervals with regular complete rows of small, conical, closely-set tubercles—except that on interval 4, which ceases at the summit of the declivity; the tubercles increase slightly in size towards apex, being subcristate on the declivity of interval 2. The entire surface, including the apices of the tubercles, is densely clothed with variegated grey and brown scaling. *Legs* short and thick, with dense pale scales and setæ; posterior tarsi with the joints of about the same width, 2nd and 3rd joints subequal in length, the 1st distinctly longer.

NAMAQUALAND: O'okiep (*L. Péringuey*).

TYPE in the British Museum.

A well-marked species, approaching the aberrant *dregei* Gyl., but apart from being smaller and of a different colour, the rostral horn is much larger and its apices divergent; the thoracic tubercles are smaller, more conical and more closely set; the prosternum has a strong conical projection just in front of the anterior coxæ; while the large intra-apical tubercular prominence of *dregei* is represented by a very slight elevation. The prosternal projection is a unique character in the genus.

113. †H. ARMATUS Fåhr.

H. armatus, Fåhr. Öfv. K. Vet.-Akad. Förh. 1871, p. 217.

Long. 10½–12, lat. 5–5½ mm.

Head coriaceous and with brown scaling, convex on vertex, forehead flattened, but without any carina or fovea; anteocular furrows distinct, approaching above. *Rostrum* not cut off from head by a basal incision, as long as prothorax, stout, curved and dilated towards apex. Upper surface rugose and squamose, with five carinæ, the median one being narrower and sharper than the others, which are more obtuse and unite apically on each side, the three central carinæ converge towards base to form a stout erect parallel-sided tubercle which is emarginate at apex; upper lateral sulci broad and uniting at base, the lower pair much narrower; scrobes deep, lateral and oblique; inferior basal furrow very deep. *Antennæ* short and thick; scape scarcely reaching eye; the two basal joints of funicle subequal. *Prothorax* as long as broad, apex and base of equal width, sides ampliated, broadest rather before middle, dorsal anterior margin convex, ocular lobes well developed. Upper surface convex, closely set with rounded tubercles, leaving a very indistinct central furrow without any carina; tubercles bare and with depressed dark setæ, the interstices with brown scaling. *Elytra* ovate, scarcely narrower in ♂, shoulders roundedly prominent, sides slightly ampliated, broadest rather before middle; apical processes absent. Upper surface convex, with rows of shallow punctures separated by small granules and scarcely visible through the scaling; interval 1 with a row of small rounded tubercles; intervals 3, 5, and 7 with rows of large, smooth, elongate distant tubercles; intervals 2 and 4 plane; 6 with two to four isolated [illegible]; tubercles bare, shiny,

and with dark depressed setæ, the interspaces with dense uniform brown scaling. *Legs* thick, with sparse ochreous scaling, forming a denser ring near apex of posterior femora; posterior tibiæ gently curved in both sexes; posterior tarsi broad, the joints of the same width, 2nd and 3rd subequal, 1st rather longer.

NATAL: Estcourt.

TYPE in the Stockholm Museum.

The large elongate and distant granules on the elytra distinguish this insect from all the other small species having a rostral horn.

114. †H. MONITOR Fåhr.

H. monitor, Fåhr. Öfv. K. Vet.-Ak. Förh. p. 215 (1871).

Long. 14, lat. 5½ mm.

Head closely punctured and densely covered with large fulvous scales; vertex convex, forehead flattened and with a faint central carina; anteocular furrows distinct. *Rostrum* short and stout, as long as prothorax only, without any basal dorsal incision, slightly curved and dilated to apex. Upper surface with a stout basal tubercle, which has its sides parallel and its apex emarginate; anterior part rugosely punctured, with a shallow central furrow containing a narrow sharp carina which ascends the basal tubercle, the raised edges of the furrow subgranulate; lateral sulci deep, subequal, the upper pair meeting at base; scrobes rather intermediate in position, but tending to an inferior direction at base; inferior basal furrow very broad and deep. *Antennæ* short, the scape scarcely reaching eye; the two basal joints of funicle subequal. *Prothorax* somewhat transverse, apex and base of equal width, sides strongly rounded, broadest well before middle, anterior dorsal margin subtruncate, ocular lobes moderate. Upper surface convex, closely set with small granular tubercles, leaving a very narrow central furrow without any carina; tubercles bare, shiny, each with a depressed seta; interstices with dense brownish scaling. *Elytra* ovate, shoulders sloping, sides gently rounded, broadest before middle, apical processes absent. Upper surface convex, with regular rows of indistinct punctures separated by small granules; interval 1 with a row of granules increasing in size towards apex; intervals 2 and 4 devoid of tubercles; 3, 5, and 7 with complete rows of small rounded tubercles, those close to base being rather smaller; interval 6 with a row of four or five similar tubercles, abbreviated both at base and apex. *Legs* with scattered pale scaling, forming a denser ring near apex of femora; posterior tarsi broad, spongy beneath, the joints of the same width, 2nd and 3rd subequal in length, 1st rather longer.

TRANSVAAL: Lydenburg (*Dr. J. W. B. Gunning*).

TYPE in the Stockholm Museum.

115. H. NASUTUS Fåhr.

H. nasutus Fåhr. Öfv. K. Vet.-Akad. Förh. 1871, p. 216.

Long. 9–11, lat. 4½–5 mm.

Head coriaceous, with dense brown scaling, convex on vertex, forehead much depressed and sometimes with a faint central carina; anteocular furrows absent. *Rostrum* not incised at base, as long as prothorax, thick, dilated at apex and somewhat curved. Upper surface densely squamose, with five carinæ, the three central ones converging towards base to form a stout erect parallel-sided tubercle, which is bifid at apex, of these latter carinæ the outer ones are distinctly angulated above the insertion of the antennæ; both pairs of lateral sulci uniting at base, the lower pair narrow, the upper broad and shallow towards base; scrobes very shallow, lateral; inferior basal furrow distinct. *Antennæ* with the scape sinuate and more clavate than usual, just reaching eye; the two basal joints of funicle subequal, not much longer than the others. *Prothorax* strongly transverse, apex scarcely narrower than base, sides much ampliated, broadest about middle, dorsal anterior margin slightly convex, ocular lobes moderate. Upper surface convex, irregularly set with small rounded tubercles, leaving a narrow central furrow containing no carina and a broader smooth space on either side of it; tubercles bare, with depressed dark setæ, the interstices with dense fulvous scaling. *Elytra* ovate, subacuminate in ♀, shoulders sloping, sides somewhat ampliated, broadest rather before middle, apices separately rounded in ♀ only. Upper surface convex, with regular rows of strong ocellated punctures, visible through the scaling; intervals 1, 3, 5, and 7 elevated and with rows of smooth elongate tubercles, which are mostly contiguous so as to form distinct costæ; intervals 2, 4, and 6 quite plane; apices of tubercles bare and with depressed pale setæ, the interspaces with dense fulvous scaling. *Legs* with sparse fulvous scaling, except on the entire apices of femora which are densely squamose; posterior tarsi with the 3rd joint rather broader than the others, 2nd and 3rd subequal in length, 1st longer.

Orange River Colony: Bothaville (*Dr. H. Brauns*).

Type in the Stockholm Museum.

The basal impressed line on the rostrum referred to by Fåhræus in his description is caused by the junction of the lower pair of lateral sulci (an unusual character in this section) and is very different from that mentioned in the case of *monitor*, *armatus*, &c., which is due to the dorsal approximation of the anteocular furrows. The entire absence of these latter furrows at once distinguishes *nasutus* from all the other species having a rostral tubercle and a short scape; indeed in its rostral structure it is more nearly allied to the long-scaped species, such as *talpa*, &c., which also lack the anteocular furrows.

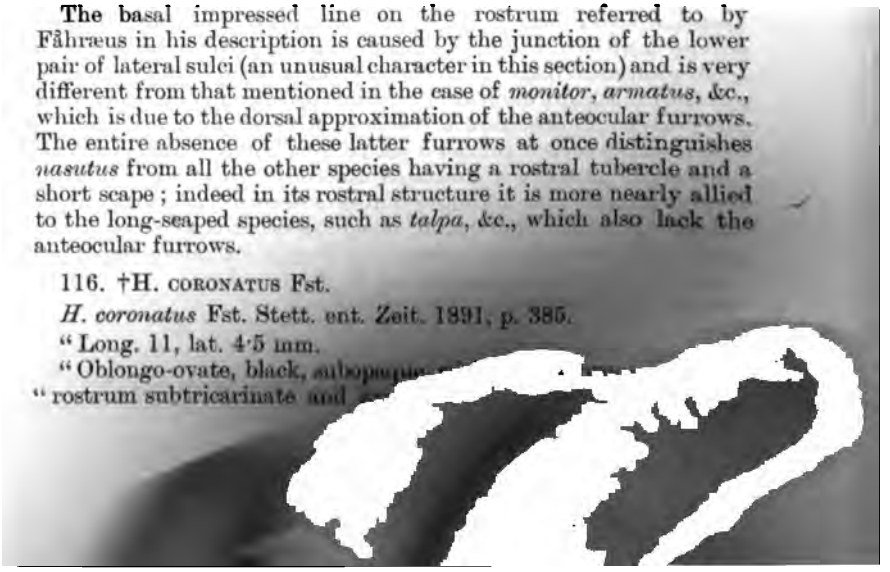
116. †H. coronatus Fst.

H. coronatus Fst. Stett. ent. Zeit. 1891, p. 385.

"Long. 11, lat. 4·5 mm.

"Oblongo-ovate, black, subopaque

"rostrum subtricarinate and



"bifid at apex; forehead depressed and with an obsolete furrow; "prothorax transverse, set above with cylindrical spines which "are truncate and bear a puncture at apex; elytra roundedly "acuminate at apex, granulato-striate at base, simply striate "towards apex, suture and dorsal intervals with a single row of "granules.

"Apart from *H. transvaalensis* Péringuey and the present "species no *Hipporrhinus* has been described in which the thorax "is set with cylindrical spines as in *Epichthonius*. But Mr. "Péringuey's species is 30 mm. long and has no rostral horn.

"Upper surface of rostrum plane, with two lateral carinæ "uniting towards the base to form a bifid horn and enclosing a "triangular space which is faintly carinate in the middle. "Anterior margin of thorax faintly bisinuate and with broad "ocular lobes; the cylindrical spines become converted laterally "into tubercles, which latter, as also the sharp tubercles on the "elytra, bear a blackish depressed seta which is set in a puncture "and directed backwards. The thorax and elytra closely set with "round bare spots. The underside with very sparse hairs, squamose "only towards the sides. Femora with a dense ring of scales near "the apex.

"TRANSVAAL. (Described from a ♀)."

TYPE in the Dresden Museum.

Dr. Faust's statement that no previously described species except *transvaalensis* Pér. possesses cylindrical spines on the thorax is incorrect, for both *spinicollis* Gyl. and *thoracicus* Fåhr. exhibit in a marked degree this character, which, moreover, is not present in *transvaalensis*. However, *coronatus* is the only described species which has spines on the thorax in conjunction with a rostral horn.

117. H. CONSORS Mshl. (Plate IV. fig. 4.)

H. consors Mshl. l. c. p. 444 (1902).

Long. 11, lat. 5½ mm.

Head with dense brownish scaling, vertex convex, forehead plane and without carina or fovea; anteocular furrows distinct but not very deep. *Rostrum* not incised at base, shorter than prothorax only, very little curved, dilated to apex. Upper surface closely but faintly punctured, densely covered with greyish scaling, with a large tubercular horn close to base, which is strongly bifid and distinctly dilated at apex; the anterior part without furrows and smooth except for a very faint central carina; both pairs of lateral sulci almost obsolete; scrobes deep, lateral and oblique; inferior basal furrow deep. *Antennæ* short, thick and squamose; scape just reaching eye; the two basal joints of funicle subequal, not much longer than the others. *Prothorax* transverse, apex and base of equal width, sides strongly rounded, broadest rather before middle, with a transverse impression near apex, dorsal anterior margin truncate, ocular lobes well developed. Upper surface convex, fairly closely set with small rounded tubercles, leaving a narrow central furrow without a carina; tubercles bare and with

very short depressed pale setæ, the interstices with thick grey scaling. *Elytra* short ovate, shoulders sloping, sides distinctly rounded, broadest about middle, apical processes absent. Upper surface convex, with shallow striæ containing very indistinct punctures separated by small granules; these disappear towards apex and are normally hidden by the scaling; intervals evenly raised and with regular and complete rows of small separated granular tubercles, those on intervals 3 and 5 being often more distant; tubercles rounded, bare and shiny, each with a very short depressed seta, the interstices variegated with large patches of pale scaling, the most conspicuous of which is a large transverse patch at the summit of the declivity. *Legs* with pale scaling which is thicker near apex of femora; the posterior tarsi short and broad, the three basal joints subequal.

TRANSVAAL: Lydenburg.

TYPE in the British Museum.

Allied to *monitor* Fåhr., from which it may be distinguished by its different shape, the elytra being shorter and broader; its intervals 2 and 4 are also regularly granulate; and the central carina on the rostrum is almost obsolete.

118. H. CORNICULATUS Fåhr.

H. corniculatus Fåhr. Öfv. K. Vet.-Akad. Förh. 1871, p. 215.

Long. 10–15, lat. 4½–6 mm.

Head closely but shallowly punctured and with dense brown scaling, vertex convex, forehead strongly depressed and with a more or less distinct central carina; anteocular furrows deep, approaching very closely above, being separated only by a narrow carina. *Rostrum* not separated from head by a complete transverse incision, as long as prothorax, thick, strongly curved, gradually dilated to apex. Upper surface rugosely punctured and densely squamose, with five narrow carinæ, the median one straight and distinct, the others undulating and sometimes indistinct, the three central ones converging at base to form a stout prominent tubercle, which is strongly bifid at apex. Behind the tubercle is a short central carina continuous with that on forehead; lateral sulci distinct, the upper pair rather broader and deeper and uniting at base; scrobes deep, lateral and oblique; inferior basal furrow very deep. *Antennæ* short and thick, clothed with fairly dense pale setæ; scape barely reaching eye; the two basal joints of funicle subequal. *Prothorax* very narrow in comparison with the elytra, as long as broad, apex scarcely narrower than base, sides rounded, broadest well before middle, dorsal anterior margin truncate or slightly convex, ocular lobes prominent. Upper surface convex, moderately closely set with small rounded tubercles, leaving a distinct but narrow central furrow without any carina; tubercles shin[illegible] depressed seta, the interstices with dense brow[illegible] ovate, a little narrower in ♂, shoulders rou[illegible] sides sli[illegible] ampliated, broadest about mid[illegible]

surface convex, the sulci containing rows of deep punctures clearly visible through the scaling; the intervals of even height, each with a row of large, rather distant granules, which are shiny and bear depressed pale setæ, the interspaces with dense brownish or greyish scaling. *Legs* thickly clothed with brownish scaling, forming a rather denser ring near apex of femora; posterior tarsi with the joints all of the same width, 2nd and 3rd subequal in length, 1st a little longer.

Orange River Colony: Bothaville (*Dr. H. Brauns*). Transvaal: Pretoria (*W. L. Distant*), Lydenburg. Mashonaland: Umtali (*A. Bodong*).

Type in the Stockholm Museum.

119. H. propinquus, sp. nov. (Plate IV. fig. 5.)

Long. 12–14, lat. 5½–7 mm.

Head covered with dense grey scaling, convex on vertex, forehead strongly depressed and with a distinct central carina; anteocular furrows deep, approximated above. *Rostrum* not completely cut off from head by a transverse incision, slightly curved and dilated towards apex. Upper surface densely squamose, with five carinæ, the central one being narrower than the others, the three median carinæ converge near base to form a prominent tubercle which is distinctly bifid at apex; behind the tubercle is a short carina continuous with that on forehead; upper lateral sulci broad, deep and uniting at base, the lower pair much shallower, shorter and narrower; scrobes deep, lateral and oblique; inferior basal furrow distinct. *Antennæ* short and thick, clothed with pale setæ; scape barely reaching eye; the two basal joints of funicle subequal. *Prothorax* transverse, apex rather narrower than base, sides rounded, broadest somewhat before middle, dorsal anterior margin slightly convex, ocular lobes moderate. Upper surface convex, moderately closely set with small rounded tubercles, leaving an indistinct central furrow containing no carina; apices of tubercles bare and with short depressed pale setæ, the interstices with dense grey scaling. *Elytra* ovate, a little narrower in ♂, shoulders roundedly prominent, sides slightly ampliated, broadest rather before middle, apical processes absent. Upper surface convex, with shallow sulci containing rows of small punctures, which are normally quite concealed by the scaling; the intervals of even height, each with a row of small, fairly closely-set granules, bearing pale depressed setæ, the interspaces with dense grey scaling. *Legs* with sparse greyish scaling, forming a denser ring near apex of femora; posterior tarsi with the joints of about the same width, 2nd and 3rd subequal, 1st rather longer.

Mashonaland: Salisbury.

Type in the British Museum.

Very closely allied to *corniculatus* Fåhr., of which it is the northern representative. It may be distinguished from that species by the following characters: the rostrum is not nearly so deep and much less curved, the inferior basal furrow much

shallower; the prothorax is distinctly broader; the sulci on the elytra are shallower, and the punctures in them smaller and quite hidden by the scaling; the granules on the intervals are smaller and more closely set.

A common species at Salisbury, where it feeds on several low herbaceous plants, but especially on a species of *Pseudarthria*.

120. H. BIMACULATUS Mshl. (Plate IV. fig. 6.)

H. bimaculatus Mshl. l. c. p. 456 (1902).

Long. 10½–12, lat. 4½–5½ mm.

Head convex, closely and distinctly punctured and with thin yellowish scaling, forehead with a small bare smooth spot near base of rostrum; anteocular furrows absent. *Rostrum* not incised at base, as long as prothorax only, scarcely curved and slightly dilated towards apex. Upper surface convex, with a fine smooth central carina and two, much less distinct, on either side; lateral sulci broad and shallow, uniting at base, where the central part of the rostrum is slightly raised so as to form a rudimentary basal tubercle; scrobes shallow, lateral and oblique; inferior basal furrow absent. *Antennæ* rather longer in the ♂; scape reaching the posterior margin of eye; the two basal joints of funicle subequal. *Prothorax* in the ♂ a little broader than long, the length being equal to the width of both base and apex; in the ♀ distinctly transverse, the length being shorter than the width of base or apex; sides strongly rounded, broadest about middle, dorsal anterior margin sinuate; ocular lobes almost obsolete. Upper surface convex, closely set with low granular tubercles, bearing depressed pale setæ and leaving a very narrow central furrow without any carina; scaling brown, with three narrow pale lines. *Elytra* ovate and acuminate posteriorly in ♀, narrower and subelliptical in ♂, shoulders sloping, sides rounded, broadest rather before middle, apical processes absent. Upper surface convex, with shallow striæ containing regular rows of small punctures; intervals all equally raised, each bearing a single row of shiny setigerous granules, which are largest near base and rapidly diminish in size towards apex; scaling dense, variegated brown and grey, with a small but conspicuous white spot at the declivity on the third interval. *Legs* with fine grey pubescence; intermediate tibiæ curved internally just before apex, but much more markedly so in the ♂; this sex also has the posterior tibiæ very strongly compressed laterally just before apex; posterior tarsi with the 2nd joint a trifle narrower than the others, 2nd and 3rd subequal, 1st joint very long and broad in ♂, longer than 2nd and 3rd together, but normal in ♀.

MASHONALAND: Salisbury.

TYPE in the British Museum.

The strong compression of the posterior tibiæ of the male is a character which, so far as I am aware, does not occur elsewhere in the genus; the striking difference in the posterior tarsi of the two sexes is also very unusual.

121. H. CERVINUS, sp. nov. (Plate IV. fig. 7.)

Long. 10–12, lat. 4–5½ mm.

Head deeply set, flattened on forehead, with close shallow punctuation and dense fulvous scaling; anteocular furrows absent. *Rostrum* as long as prothorax, stout, thick, scarcely curved and gradually dilated to apex. Upper surface punctured and scaled like the head, with a very faint abbreviated central carina and a stronger one on either side of it, which converge towards base to form a low prominence (more strongly developed in ♀); lateral sulci rather broad and shallow, uniting at base; scrobes very shallow, lateral and oblique; inferior basal furrow present but not well developed. *Antennæ* piceous, with fine pale setæ; scape reaching posterior margin of eye; the two basal joints of funicle subequal. *Prothorax* distinctly transverse, apex and base of equal width, with a shallow constriction close to former, sides rounded, broadest about middle, anterior margin truncate or slightly concave; ocular lobes feeble. Upper surface convex, closely set with small granules, and without any distinct central furrow; granules bare, shiny, each with a depressed fulvous seta, the interstices with fulvous scaling, except for three narrow longitudinal white lines. *Elytra* ovate, much broader in ♀, in which they are distinctly acuminate apically, shoulders sloping, sides rounded, broadest rather before middle, apical processes absent. Upper surface convex, with broad shallow sulci, containing regular rows of ocellated punctures which are almost hidden by the scaling; the intervals equally raised and very slightly costate; the extreme lateral intervals alone with faint traces of low granules; the dorsal intervals entirely without granules, which are replaced by regular rows of depressed pale setæ; scaling very dense and even throughout, of a fulvous-grey or brown colour. *Legs* thinly clothed with pale setæ; posterior tarsi narrow, elongate, the 3rd joint rather broader than the others, 1st joint longer than 2nd, and 2nd than 3rd.

ORANGE RIVER COLONY: Dewetsdorp (*Dr. H. Brauns*), Kronstad [S. A. Mus.]. TRANSVAAL: Lydenburg.

TYPES—♂ in the British Museum; ♀ in the Stockholm Museum.

In addition to the 4 ♂♂ of this species kindly sent me by Dr. Brauns, I have received a Transvaal example from Dr. Walter Horn; there are 3 ♂ ♂ in the S. African Museum, but the only ♀ I have yet seen is that at Stockholm.

The characters given in the key sufficiently distinguish this species from *bimaculatus* Mshl. Of the other species with elongate scapes, *talpa* Fåhr. is the only one which at all resembles it. Apart from its rudimentary rostral tubercle, *cervinus* may be separated from *talpa* by its much longer and narrower tarsi, in which the joints are of different proportionate lengths; and also by the apical constriction of the thorax, which causes the anterior margin to have a slightly upturned appearance which is very characteristic of the species.

122. †H. TALPA Fåhr.

H. talpa Fåhr. Öfv. K. Vet.-Akad. Förh. 1871, p. 217.

Long. 8½–10, lat. 4–4½ mm.

Head coriaceous, squamose, convex on vertex, forehead flattened and with a short central stria; anteocular furrows absent. *Rostrum* not cut off from head at base, as long as prothorax, thick, curved and dilated towards apex. Upper surface squamose, with five carinæ, the outer ones uniting apically and the three central ones converging towards base to form a stout erect tubercle, which is more or less strongly dilated to apex and there emarginate; the central carina abbreviated anteriorly; lateral sulci shallow, especially the lower pair which is much narrower than the upper, both pairs unite at base; scrobes lateral, very shallow; inferior basal furrow deep. *Antennæ* with scape reaching the middle of eye; the two basal joints of funicle subequal. *Prothorax* as long as broad in ♂, transverse in ♀, apex almost as broad as base, sides rounded, broadest about middle, dorsal anterior margin truncate; ocular lobes moderate. Upper surface convex, closely set with small rounded granules, leaving a very narrow central furrow without any carina; granules bare, each with a depressed pale seta, the interstices with brown scaling except for three narrow longitudinal white lines. *Elytra* ovate, subacuminate in ♀, shoulders sloping, sides rounded, broadest rather before middle, apical processes absent. Upper surface convex, with shallow sulci, containing rows of indistinct punctures separated by minute granules; the intervals all of even height, each with a row of small low granules, which are shiny and bear depressed pale setæ, the interspaces with dense brown scaling variegated with grey; on the juxta-sutural intervals the granules are not so distinct as towards the sides. *Legs* with grey scaling; posterior tarsi with the joints of about the same width, 2nd and 3rd subequal in length, 1st longer.

TRANSVAAL: Lydenburg [don. *Dr. J. W. B. Gunning*]. MASHONALAND: Marandella's (6000 ft.). PORT. E. AFRICA: Delagoa Bay (*H. Junod*).

TYPE in the Stockholm Museum.

This species appears to vary a good deal in the development of the rostral horn. In my Mashonaland examples this horn is comparatively small, almost parallel-sided and very slightly emarginate apically. In the series taken by Wahlberg (presumably in the Transvaal) it is distinctly longer and dilated apically, and in one specimen the dilatation is much more strongly marked than in the rest.

123. H. VICINUS Mshl. (Plate IV. fig. 8.)

H. vicinus Mshl. l. c. p. 452 (1902).

Long. 10, lat. 5 mm.

Head convex, densely covered with brown scaling, forehead without fovea or carina; anteocular furrows absent. *Rostrum* not incised at base, short and thick, shorter than the prothorax,

scarcely curved, strongly dilated from base to apex, a little more slender in ♂ than in ♀. Upper surface with a short basal tubercle which has its sides subparallel and its apex sharply bifurcated; anterior portion almost plane, rugosely punctured, and with a faint carina running from the middle back to the apex of the tubercle; lateral sulci indistinct, the upper pair uniting at base; scrobes shallow, lateral and oblique; inferior basal furrow very deep. *Antennæ* with scape reaching to about middle of eye; the two basal joints of funicle subequal. *Prothorax* rather transverse, apex about as wide as base, sides strongly rounded, broadest about middle, dorsal anterior margin truncate; ocular lobes very feeble. Upper surface convex, closely set with small granules, the central furrow being almost obsolete; granules bare, shiny, and with depressed pale setæ, the interstices with brown scaling and three pale longitudinal lines. *Elytra* short ovate, broadest before middle, shoulders sloping, bluntly rounded apically in ♂, subacuminate in ♀; apical processes absent. Upper surface convex, distinctly sulcate, the sulci with rows of ocellated punctures, sometimes hidden by the scaling; intervals carinate, but especially 3, 5, and 7, which are rather higher than the others; intervals 1 and 2 with no granules, but with regular rows of recumbent setæ; the other intervals have rows of minute setigerous granules, which disappear near apex and are there replaced by depressed setæ; scaling dense, variegated brown and grey, granules bare and shiny. *Legs* with scattered pale scaling and without a femoral ring; posterior tarsi with the 2nd joint rather narrower than the adjoining ones, 2nd and 3rd subequal in length, 1st rather longer.

Natal: Estcourt.

Type in the British Museum.

A fairly common species in the uplands of Natal, where it replaces its near ally *talpa* Fåhr. This latter species differs in having the intervals on the elytra less raised and of even height, and it also has a fovea on the forehead.

124. H. brevis Mshl. (Plate IV. fig. 9.)

H. brevis Mshl. l. c. p. 450 (1902).

Head convex on vertex, which is closely and distinctly punctured; forehead flattened, with fine convergent plications and a short low central carina near the rostrum bearing a single fovea; anteocular furrows absent. *Rostrum* not incised at base, short and thick, as long as prothorax only, slightly curved. Upper surface with a stout basal tubercle which has its sides rather convergent and its apex sharply bifurcated; anterior part almost plane, rugosely punctured, and with a very faint short carina; lateral sulci broad and distinct, uniting at base; scrobes lateral and curved; inferior basal furrow very deep. *Antennæ* with scape reaching to about middle of eye; the two basal joints of funicle subequal. *Prothorax* transverse, the length equal to the width at base, which is as broad as the apex; ocular lobes distinct. Upper surface convex, closely set with low granules, each bearing

a pale depressed seta; scaling brown, with three narrow and indistinct paler lines. *Elytra* very short, ovate, sides strongly rounded, broadest before middle, acuminate behind (♀), shoulders rounded, apical processes absent. Upper surface rather convex, striæ with rows of shallow subreticulate foveæ, intervals evenly raised and with large, very depressed, shiny, distant granules, which bear depressed pale setæ; scaling not very dense, yellowish brown. *Legs* with scattered pale scaling, forming a denser ring at apex of femora; posterior tarsi with the three basal joints of about the same width, 2nd and 3rd subequal in length, 1st longer.

CAPE COLONY.

TYPE in the British Museum.

125. H. INCERTUS Mshl. (Plate IV. fig. 10.)

H. incertus Mshl. l. c. p. 454 (1902).

Long. 10, lat. 4½ mm.

Head with dense brown scaling, vertex convex and closely punctured, forehead strongly depressed, indistinctly punctured and without a fovea or carina; anteocular furrows obsolete. *Rostrum* not incised at base, short and thick, about as long as prothorax only, scarcely curved and strongly dilated to apex. Upper surface with a stout basal tubercle, which has its sides subparallel and its apex sharply bifid; anterior part slightly excavated, closely punctured, and with a narrow but distinct central carina which ascends the tubercle; lateral sulci meeting at base, the upper pair broad and shallow, the lower narrower and deeper; scrobes lateral and curved; inferior basal furrow broad and deep. *Antennæ* with scape reaching the posterior margin of eye; the second joint of funicle rather longer than first. *Prothorax* transverse, its length equal to the width of both base and apex, sides rounded, broadest about middle, dorsal anterior margin truncate, ocular lobes feeble. Upper surface convex, fairly closely set with small separated conical tubercles, arranged in more or less irregular longitudinal rows and leaving a narrow central furrow without any carina; tubercles black, shiny, and each with a depressed dark seta, the interstices with uniform brown scaling. *Elytra* ovate, shoulders sloping, sides distinctly rounded, broadest before middle, ♀ more acuminate posteriorly than ♂; apical processes absent. Upper surface convex, with faint striæ containing rows of indistinct punctures, sometimes separated by minute granules; intervals 1, 3, 5, and 7 with regular and complete rows of granules; intervals 2, 4, and 6 without any, or at most a few isolated, granules; granules black, shiny, each with a depressed dark seta; scaling thin, uniform brown. *Legs* black, with sparse brownish-grey scaling and a paler ring near apex of femora; posterior tarsi with the 3rd joint rather broader than the other two, 2nd and 3rd subequal, 1st longer.

MASHONALAND: Salisbury, Marandella's.

TYPE in the British Museum.

From the other long-scaped species having a rostral tubercle,

incertus may be distinguished by the sparser and more elevated granules on the prothorax, the almost entire absence of granules on intervals 2, 4, and 6 of the elytra, and the much larger and more distant granules on the remaining intervals.

126. H. ARENARIUS Fåhr.

H. arenarius Fåhr. Öfv. K. Vet.-Akad. Förh. p. 210 (1871).

Long. 12, lat. 5½–6 mm.

Head convex on vertex, forehead flattened and usually with a shallow central fovea, punctuation close and deep but hidden beneath the dense brown scaling; anteocular furrows obsolete. *Rostrum* not incised at base, about as long as prothorax only, very little curved. Upper surface with three narrow and slightly undulating carinæ converging towards base, which is higher than the plane of forehead, punctuation coarse but hidden by the scaling; lateral sulci distinct, the upper pair broader and meeting at base; scrobes lateral but not very oblique; inferior basal furrow very deep. *Antennæ* piceous, setose; scape curved, exceeding the anterior, but not the posterior, margin of eye; the two basal joints of funicle subequal. *Prothorax* in ♂ slightly broader than long, the length a little greater than the width at base; in ♀ more transverse, the length less than the width at base; apex narrower than base, sides moderately rounded, broadest about middle, dorsal anterior margin truncate; ocular lobes feebly developed. Upper surface convex, closely set with small rounded granules, leaving a narrow central furrow without a carina; granules bare, interstices with thick brown scaling. *Elytra* ovate in ♂, broader and more convex in ♀, shoulders sloping, sides moderately rounded, broadest about middle, apical processes very short in ♀, absent in ♂. Upper surface convex, sulcate, the sulci containing rows of large shallow punctures with minute intervening granules; intervals all equally raised, each having a single row of granules bearing short depressed pale setæ; scaling dense, dark brown, partly concealing the sculpturing of the sulci. *Legs* with dense scaling except on basal half of femora which is finely setose; the legs are markedly thicker in the ♂ and the tibiæ are more curved, the hind pair having a strong tooth before middle on the interior edge; posterior tarsi with the 2nd joint slightly narrower than the others, 2nd and 3rd subequal in length, the 1st longer.

MATABELELAND: Bulawayo (*J. P. Cregoe & F. Eyles*).

TYPE (a ♀) in the Stockholm Museum.

The peculiar structure of the hind tibiæ will enable the ♂ of this species to be easily recognised; the ♀ has only a slight indication of the tibial tooth. In size and general shape the species has much the appearance of *corniculatus* Fåhr.

127. H. SERIEGRANOSUS Gyl.

H. seriegranosus Gyl. Schh. Gen. Curc. v. p. 772 (1840).

Long. 11, lat. 4 mm.

Head convex, closely and rather rugosely punctured throughout, forehead flattened, but without fovea or carina; eyes unusually large, the space between them narrower than the base of rostrum; anteocular furrows entirely absent. *Rostrum* rather shorter in ♀, not incised dorsally at base, as long as prothorax, comparatively slender and almost straight. Upper surface with five narrow low carinæ, the interspaces coarsely punctured and with fine suberect setæ; lateral sulci deep and subequal in length, the upper pair parallel, but each one running into the basal impression; scrobes lateral, sinuate; inferior basal furrow absent. *Antennæ* elongate, with scape reaching posterior margin of eye; the two basal joints of funicle subequal. *Prothorax* as long as broad in ♂, shorter and slightly transverse in ♀, apex narrower than base, sides slightly rounded, broadest behind middle, dorsal anterior margin truncate; anteocular lobes feeble. Upper surface convex, fairly closely set with small tubercles which are cylindrical on disk but lower and rounded towards the sides; central furrow narrow, ill-defined, and without a carina; tubercles bare, each with a suberect dark seta, the interstices with brownish-grey scaling. *Elytra* subelliptical in ♂, ovate in ♀, shoulders sloping, sides moderately rounded, more so in ♀, broadest before middle in ♀, about middle in ♂; apical processes absent. Upper surface convex, with regular rows of fine closely-set punctures; intervals all similar, bearing complete rows of large, rounded and distant granules, each bearing a depressed pale seta; scales greyish, very small and thinly scattered. *Legs* slender, elongate, sparsely clothed with white setæ; posterior tarsi long and narrow, the 3rd joint broadest, being strongly lobate, 1st joint elongate, rather broader than 2nd and almost as long as 2nd and 3rd together.

Cape Colony.

128. †H. longulus Gyl.

H. longulus Gyl. Schh. Gen. Curc. v. p. 773 (1840).

Head convex, densely and rugosely punctured, sparsely squamose; anteocular furrows absent. *Rostrum* not incised at base, as long as prothorax, slightly curved, sides almost parallel throughout, very little dilated at apex. Upper surface with five narrow carinæ, the three median ones being almost smooth and continuous throughout, the lateral ones undulating; upper lateral sulci meeting at base and longer than the lower; scrobes lateral, shallow; inferior basal furrow absent. *Antennæ* with the scape reaching posterior margin of eye; the two basal joints of funicle subequal. *Prothorax* longer than broad, base a little narrower than apex, sides moderately rounded, broadest at, or a little before, middle, dorsal anterior margin slightly emarginate; ocular lobes moderately developed. Upper surface slightly convex, closely set with rounded subdepressed tubercles, leaving a very narrow central furrow without any carina; tubercles bare and with setigerous punctures, the interstices with grey scaling and

three indistinct paler lines. *Elytra* narrowly ovate, shoulders very sloping, sides slightly rounded, broadest before middle, the apices conjointly rounded. Upper surface convex, with shallow sulci containing rows of granules, the intervals slightly convex and set with rows of small remote tubercles bearing long black setæ, the interspaces with sparse grey and white scaling. *Legs* rather long, with thin greyish setæ; posterior tarsi with the 1st joint elongate, 2nd and 3rd subequal.

CAPE OF GOOD HOPE (*Drège*).

TYPE in the Stockholm Museum.

I have seen only the single example at Stockholm from Drège's collection. Fåhræus distinguishes this species from *seriegranosus* Gyl., to which it is closely allied, by its much smaller size and convex forehead, by the prothorax being ampliated at, or a little before, middle, and its apex not being narrower than the base.

129. †H. SJÖSTEDTI, sp. nov.

Long. 12, lat. 5 mm.

Head convex, bare, closely and strongly punctured, forehead with a faint central impression; anteocular furrows absent. *Rostrum* not incised at base, as long as prothorax, comparatively slender, slightly curved and scarcely dilated towards apex. Upper surface with five narrow straight carinæ; lateral sulci not uniting at base, the upper pair very narrow and elongate, the lower pair shorter, broader and deeper; scrobes lateral, shallow; inferior basal furrow absent. *Antennæ* very long and slender, the scape exceeding the posterior margin of eye; second joint of funicle distinctly longer than first. *Prothorax* slightly broader than long, apex narrower than base, sides rounded, broadest rather before middle, dorsal anterior margin truncate; ocular lobes almost obsolete. Upper surface nearly plane, moderately closely set with low rounded granules, leaving a very narrow and indistinct central furrow; granules bare, with short depressed pale setæ, the interstices with only a few scattered white scales towards the sides. *Elytra* very elongate ovate, shoulders sloping, sides moderately rounded, broadest before middle; apical processes absent. Upper surface convex, with shallow sulci containing rows of small granules, the intervals similar, slightly convex, and each with a regular row of separate rounded granules, bearing very short depressed setæ; the interspaces with very sparse minute white scales. *Legs* very long and slender, piceous, and with scattered pale setæ; posterior tarsi elongate, the 3rd joint much broader than the others, 2nd narrower and much shorter than 1st, but subequal to 3rd in length.

CAPE COLONY: Gavios (*Westring—coll. Schönherr*).

TYPE in the Stockholm Museum.

Very similar in general facies to *seriegranosus* Gyl., from which it differs among other points in the much longer and more slender rostrum, in having the 2nd joint of the funicle longer than the 1st, and in the greater dilatation of the 3rd tarsal joint.

130. H. GRANICOLLIS (Gyl.).

Prypnus granicollis Gyl. Schönh. Gen. Curc. i. p. 496 (1833).
Prypnus cicatricosus Gyl. l. c.
H. granicollis Fåhr. op. c. v. p. 776 (1840).

Long. 11–12, lat. 5½–6 mm.

Head convex, with dense brown scaling, forehead not depressed, usually with a short stria or fovea; anteocular furrows absent. *Rostrum* not incised at base, as long as prothorax, slightly curved, dilated to apex. Upper surface punctured and squamose, with five smooth narrow undulating carinæ; lateral sulci distinct, the upper pair meeting at base and much longer than the lower; scrobes not very deep, lateral and curved; inferior basal furrow absent. *Antennæ* with sparse pale setæ; scape reaching posterior margin of eye; the two basal joints of funicle subequal. *Prothorax* transverse, apex and base of about equal width, sides strongly rounded, broadest about middle, dorsal anterior margin truncate; ocular lobes almost obsolete. Upper surface convex, fairly closely set with rounded granules, leaving an indistinct central furrow without any carina; granules bare, shiny, each with a subdepressed pale seta; the interstices with brown scaling, except the central furrow, a distinct lateral line and an ill-defined line below it, which are white. *Elytra* elliptical in ♂, broadly ovate and acuminate behind in ♀, shoulders prominent, sides slightly ampliated, broadest about middle, apical processes absent. Upper surface convex, with shallow sulci containing rows of large ocellated punctures, normally almost hidden by the scaling; the intervals evenly raised, the extreme lateral ones with rows of small granules, which, however, are absent on the dorsal ones, where they are replaced by duplicated rows of pale suberect setæ; scaling very small, circular, dense, of a brown colour often variegated with greyish, and occasionally there is a small round white spot at the summit of the declivity on the third interval. *Legs* longer and thicker in ♂ than in ♀, clothed with fine whitish setæ and with a trace of a white band near apex of femora; posterior tarsi more elongate in ♂, the 2nd joint rather narrower than the other two, 2nd and 3rd subequal in length, 1st longer.

CAPE COLONY: Grahamstown and Uitenhage (*Rev. J. A. O'Neil*), Port Elizabeth (*Dr. H. Brauns*), Somerset East, Albany, and Knysna [S. African Mus.].

TYPE in the Stockholm Museum.

Father O'Neil states that this species is found commonly round Grahamstown under stones on the grass veld, but it is very rare at Uitenhage.

131. †H. PORCULUS (Sparrm.).

Curculio porculus Sparrm. Act. Holm. i. p. 49, t. 2. f. 20 (1785).
Prypnus porculus Gyl. Schönh. Gen. Curc. i. p. 495 (1833).

Head convex, granulate, with dense brown scaling; anteocular lobes absent. *Rostrum* not incised at base, shorter than prothorax, thick, slightly curved and dilated towards apex. Upper

surface granulate and with dense brown scaling and black setæ, with narrow smooth carinæ; scrobes lateral and curved. *Antennæ* with scape reaching middle of eye; the two basal joints of funicle subequal. *Prothorax* slightly transverse, apex narrower than base, sides strongly rounded, broadest at middle, dorsal anterior margin truncate; ocular lobes almost obsolete. Upper surface slightly convex, moderately closely set with rounded granules, leaving a shallow central furrow containing no carina; granules bare, shiny, with suberect setæ; the interstices with brown scaling, except the central furrow and two abbreviated irregular lines on each side, which are white. *Elytra* ovate, acuminate apically, shoulders prominent, sides slightly ampliated, broadest rather before middle; apical processes absent. Upper surface convex, with shallow sulci containing rows of ocellated punctures almost hidden by the scaling; the intervals even, faintly granulate, the granules being more noticeable towards sides and base and bearing long erect black setæ; scaling dense, brown, variegated with grey and with an ovate white spot at the summit of the declivity on the 3rd interval. *Legs* with fine white setæ; posterior tarsi with the 2nd joint rather narrower than the others, 2nd and 3rd subequal in length, 1st longer.

Cape of Good Hope (*Sparrman*).

Type in the Stockholm Museum.

I have only seen the unique type, a ♀. The species is very closely allied to *granicollis* Gyl., from which it may be distinguished by its larger size, more acuminate elytra, its longer, more erect and black setæ, and more strongly granulate elytra.

132. H. varius Fåhr.

H. varius Fåhr. Öfv. K. Vet.-Akad. Förh. 1871, p. 211.

Long. 9–12, lat. 3½–5½ mm.

Head convex, closely and confluently punctured, with dense greyish scaling, forehead without any distinct fovea or carina; anteocular furrows absent. *Rostrum* not incised at base, as long as prothorax, slightly curved and dilated to apex. Upper surface punctured and scaled like the head, with five narrow smooth carinæ, the central one being rather more distinct than the others; lateral sulci rather shallow, the upper pair a little longer than the lower; scrobes lateral, very shallow; inferior basal furrow absent. *Antennæ* clothed with fine grey setæ; scape reaching posterior margin of eye; the joints of the funicle much more elongate in ♂ than in ♀, the two basal joints subequal in both sexes. *Prothorax* slightly transverse in ♂, more distinctly so in ♀, apex narrower than base, sides moderately rounded, broadest behind middle, anterior margin truncate, ocular lobes almost obsolete. Upper surface convex, closely set with rounded granules, leaving a very narrow central furrow containing no carina; granules with depressed pale setæ, the interstices with greyish and brownish scaling. *Elytra* subelliptical in ♂, broadly ovate and acuminate apically in ♀, shoulders sloping, sides

rounded, broadest before middle, apical processes absent. Upper surface convex, with shallow sulci, containing rows of shallow indistinct but ocellated punctures separated by small granules; the intervals of even height and bearing rows of faint depressed granules, which are more noticeable laterally; granules more or less bare, each with a pale depressed seta; the interspaces with dense greyish scaling, sometimes uniform, sometimes variegated with brown or black spots. *Legs* clothed with fine pale setæ; posterior tarsi with the 3rd joint distinctly broader than the others and the 1st a little broader than 2nd, 2nd and 3rd subequal in length, 1st longer.

NATAL: Durban (*C. N. Barker*), Estcourt. TRANSVAAL. MASHONALAND: Umtali (*A. Bodong*).

TYPE in the Stockholm Museum.

I found this species fairly plentifully at Estcourt, most of my examples having been taken in sweeping herbage or at the roots of grass-tufts.

133. H. O'NEILI, sp. nov.

Long. 11–12, lat. 5–6 mm.

Head slightly convex, closely and distinctly punctured and with dense brownish scaling, forehead finely carinate; anteocular furrows absent. *Rostrum* not incised at base, as long as prothorax only, thick, slightly curved and dilated to apex. Upper surface punctured and scaled like the head and with five smooth narrow carinæ; lateral sulci distinct, the upper uniting at base and longer than the lower; scrobes lateral and shallow; inferior basal furrow absent. *Antennæ* with scape reaching, but not exceeding, posterior margin of eye; the two basal joints of funicle subequal. *Prothorax* transverse, apex and base of equal width, sides very strongly rounded, broadest rather behind middle and constricted at apex, dorsal anterior margin sinuate; ocular lobes very feeble. Upper surface convex, moderately closely set with small rounded granules, leaving a narrow central furrow containing no carina; granules bare, with short depressed setæ, the interstices with dense brown scaling and three narrow paler lines. *Elytra* ovate, broader in ♀ and strongly acuminate apically, shoulders sloping, sides rounded, broadest about middle, apical processes absent. Upper surface slightly convex, scarcely sulcate, the striæ with regular rows of fine simple and closely-set punctures; the intervals plane on disk, but slightly convex laterally, quite smooth and finely aciculate; scaling dense, brownish or greyish (occasionally with the appearance of faint striping), the intervals with rows of short depressed pale setæ. *Legs* thinly clothed with fine greyish pubescence; posterior tarsi with the 2nd joint narrower than the two adjoining, 2nd and 3rd subequal in length, 1st much longer; in the ♂ the 1st joint is longer and much broader than in the ♀.

NATAL: Colenso [Oxford Museum], Ulundi (6000 ft.).

TYPES—♂ in the British Museum; ♀ in the Oxford Museum.

A close ally of *H. varius* Fåhr., but apart from its larger size

and stouter legs, it differs in the smoother and more even surface of the elytra and the fine simple punctuation of the striæ; the shape of the prothorax is also different owing to its much more strongly rounded sides and the presence of the shallow, but distinct, apical constriction.

134. H. LINEATUS Fåhr.

H. lineatus Fåhr. Öfv. K. Vet.-Ak. Förh. p. 213 (1871).

Long. 14–16, lat. 5½–7 mm.

Head convex, closely and finely punctured and with denser whitish scaling; forehead rather flattened and with a faint central carina; anteocular furrows absent. *Rostrum* not incised at base, as long as prothorax, scarcely curved. Upper surface with five narrow carinæ, the central one bare and a good deal higher than the others, which are more or less concealed by the denser scaling; lateral sulci not very deep, subequal, the upper pair meeting at base, which is distinctly higher than the plane of forehead; scrobes shallow, entirely lateral and scarcely oblique; inferior basal furrow absent. *Antennæ* very long, with dense white pubescence; scape extending beyond posterior margin of eye; first joint of funicle longer than second. *Prothorax* transverse, apex narrower than base, sides strongly rounded, broadest behind middle, apical margin truncate; ocular lobes almost obsolete. Upper surface convex, closely set with low rounded tubercles, leaving a central furrow (without carina) and an ill-defined smooth line on each side; tubercles bare, without setæ, interstices with dense white scaling. *Elytra* elliptical in ♂, ovate in ♀ and acuminate at apex, shoulders sloping, sides rounded, much more so in ♀, broadest about middle, apical processes absent. Upper surface convex, with finely punctured striæ which disappear before apex; the striæ all bare except the 6th, which is faintly visible through the scaling; all intervals quite plane and with stripes of white scaling; the stripes on intervals 4 and 6 broadest and most dense; those on 1 and 2 equally dense, but narrower; those on 3, 5, and 7 still narrower, less dense and less well defined; the dorsal intervals have each a row of minute dark dots in the white scales, taking towards the sides the form of small and very depressed granules; inflexed margins of elytra and underside of body densely clothed with white scaling. *Legs* much longer and thicker in ♂, in which sex the posterior tibiæ exceed the apex of elytra by more than ⅔ their length, whereas in ♀ they do so by less than ¼; scaling dense, uniform white; posterior tarsi spongy beneath, longer and thicker in ♂, 2nd joint rather narrower than the others, 2nd and 3rd subequal in length, 1st rather longer.

TRANSVAAL; ZULULAND; PORTUGUESE E. AFRICA.

TYPE in the Stockholm Museum.

135. †H. VITTATUS Fåhr.

H. vittatus Fåhr. Öfv. K. Vet.-Ak. Förh. p. 213 (1871).

Long. 11, lat. 4½ mm.

Head closely and confluently punctured and with sparse whitish scaling, vertex convex, forehead almost plane; anteocular furrows absent. *Rostrum* not incised at base, as long as head and prothorax, very little curved, dilated towards apex. Upper surface with five smooth narrow carinæ of about equal height; lateral sulci distinct, the upper pair longer and uniting at base; scrobes lateral, shallow and curved; inferior basal furrow absent. *Antennæ* with scape exceeding posterior margin of eye; the first joint of funicle longer than second. *Prothorax* slightly broader than long, apex scarcely narrower than base, sides not much rounded, broadest before middle, dorsal anterior margin truncate, ocular lobes feeble. Upper surface convex, closely set with low rounded granules, leaving a distinct central furrow containing no carina; granules bare, with depressed pale setæ, the interstices with greyish scaling, the central furrow and a narrow lateral line being white. *Elytra* narrowly ovate, broader in ♀ and subacuminate towards apex, shoulders sloping, sides rounded, broadest before middle, apical processes absent. Upper surface convex, with regular shallow striæ containing rows of deep closely-set punctures; the intervals evenly raised, slightly convex and quite smooth on disk, but with faint traces of granulation laterally; each interval with a row of depressed white setæ; the whole surface with moderately dense small white scaling, which is more or less denuded on intervals 3 and 7. *Legs* with fine whitish pubescence; posterior tarsi elongate, the 2nd joint rather narrower than the other two, 1st longer than 2nd, and 2nd than 3rd; in the ♂ the 1st joint is longer and broader than in the ♀.

"CAFFRARIA" (*J. Wahlberg*).

TYPE in the Stockholm Museum.

136. †H. SUBLINEATUS Gyl.

H. sublineatus Gyl. Schh. Gen. Curc. v. p. 775 (1840).

"*Head* rather large, subglobose, closely punctured, black with "white scaling; eyes ovate, black, slightly prominent. *Rostrum* "a little longer than head, very thick, curved, angulated, sub-"gibbose above, and with a shallow central furrow divided by a "small smooth carina, two lateral sulci adjoining on either side, "of which the upper ones are very deep, almost hidden towards "apex under the very narrow carinæ which adjoin them internally, "and subconvergent towards base for the narrow dorsal elevation; "punctured throughout, black, sparsely squamose. *Antennæ* "medium, black. *Thorax* broader than long, a little narrower "anteriorly, apex broadly emarginate, sides ampliated posteriorly, "base truncate. Upper surface slightly convex, scarcely or very "obsoletely sulcate, very closely set with low rounded tubercles "bearing depressed pale setæ; black, the interstices with sparse "grey scaling. Scutellum small, triangular, black. *Elytra* "truncate anteriorly, a little broader than the base of thorax, sides "ampliated in front, attenuate behind, apices jointly but sharply "rounded, four times longer than the thorax. Upper surface "convex, remotely striato-punctate, the punctures containing

"small setæ, the intervals faintly granulate; black, with alter-
"nating lines of dense white scaling. Body punctured beneath,
"black, with sparse white scaling. *Legs* rather long, stout, black,
"obsoletely punctured, and with white scaling.

"CAPE OF GOOD HOPE. Described from the collection of
"Mr. Drège.

"Less than half the size of *Hipporrhinus subvittatus*, notably
"shorter, the rostrum differently constructed, the thorax short,
"densely tuberculate, &c."

I have been unable to identify this species with any certainty, and the above description is taken from Gyllenhal.

137. H. SUBVITTATUS Gyl.

H. subvittatus Gyl. Schh. Gen. Curc. v. p. 774 (1840).

H. cinerascens Fåhr. Öfv. K. Vet.-Ak. Förh. p. 212 (1871).

Long. 12–14, lat. 5–6 mm.

Head convex, closely and confluently punctured, with dense brownish scaling, forehead rather flattened and with a faint central carina; anteocular furrows absent. *Rostrum* not incised at base, as long as prothorax, slightly curved and dilated towards apex. Upper surface closely punctured and scaled, with five smooth narrow carinæ, the three central ones converging towards base to form a distinct elevation; lateral sulci shallow, subtriangular in shape and of about equal length, the upper pair uniting at base; scrobes lateral, rather shallow; inferior basal furrow absent. *Antennæ* with scape just exceeding posterior margin of eye; the two basal joints of funicle subequal. *Prothorax* broader than long, apex narrower than base, sides distinctly rounded, broadest rather behind middle, dorsal anterior margin truncate; ocular lobes almost obsolete. Upper surface convex, rather sparsely set with small elevated tubercles, leaving a distinct central furrow containing no carina; tubercles bare, with depressed pale setæ, the interstices with dense whitish or greyish scaling. *Elytra* narrowly ovate in ♂, broadly ovate in ♀ and acuminate apically, shoulders roundedly prominent, sides rounded, broadest about middle, apices jointly rounded in ♂, slightly divergent in ♀. Upper surface convex, the striæ with rows of obscure punctures separated by minute granules, the intervals slightly convex, coriaceous, with faint granulation laterally, and all with regular rows of depressed pale setæ; scaling whitish or greyish, usually with the intervals 1, 3, 5, and 7 more or less denuded. *Legs* with moderately dense pale setiform scaling; posterior tarsi with the 2nd joint rather narrower than the other two, 2nd and 3rd subequal in length, 1st longer.

NATAL: Durban, Estcourt. TRANSVAAL: Lydenburg.

TYPE of *cinerascens* in the Stockholm Museum.

I can only regard *cinerascens* Fåhr. as a colour variety of this species, lacking the conspicuous striping, as I can detect no other essential difference; moreover, I have found the two forms inhabiting the same localities.

138. †H. DOLOROSUS Fåhr.

H. dolorosus Fåhr. Öfv. K. Vet.-Ak. Förh. p. 212 (1871).

Long. 13–15, lat. 5½–6½ mm.

Head convex, coriaceous, and with dense greyish scaling; anteocular furrows absent. *Rostrum* not incised at base, as long as prothorax, scarcely curved, dilated to apex. Upper surface closely punctured and scaled, with five narrow carinæ, the three central ones converging towards base to form a distinct elevation; lateral sulci shallow, about equal in length, convergent apically, the upper pair uniting at base; scrobes lateral, shallow; inferior basal furrow absent. *Antennæ* with the scape extending beyond posterior margin of eye; the two basal joints of funicle subequal. *Prothorax* transverse, apex narrower than base, sides rounded, broadest rather behind middle, dorsal anterior margin truncate or faintly sinuate; ocular lobes almost obsolete. Upper surface convex, closely set with small low rounded tubercles, leaving a narrow central furrow containing no carina; tubercles bare, with depressed pale setæ, the interstices with dense whitish scaling. *Elytra* narrowly ovate in ♂, broader in ♀ and subacuminate apically, shoulders sloping, sides rounded, broadest behind middle, apices conjointly rounded in ♂, slightly divergent in ♀. Upper surface convex, the striæ containing rows of very shallow punctures separated by minute granules; the intervals slightly convex, smooth and finely shagreened, but with traces of faint granulation on the lateral ones, and each with a regular row of white depressed setæ; scaling dense, greyish or whitish, but darker and more or less denuded on intervals 1, 3, 5, and 7. *Legs* with moderately dense depressed white setæ; posterior tarsi with the 2nd joint rather narrower than the other two, 2nd and 3rd subequal in length, 1st longer.

NATAL: Durban.

TYPE in the Stockholm Museum.

A very near ally of *subvittatus* Gyl., and distinguished from it only by the characters mentioned in the key. The narrower shoulders make the prothorax appear proportionately broader, especially in the ♀.

Species insufficiently described.

139. †H. QUADRISPINOSUS (F.).

Curculio quadrispinosus F. Gen. Ins. p. 228 (1777); Ol. Enc. Méth. v. p. 547 (1790); Herbst, Col. vi. p. 510 (1795).

Fabricius' description is as follows:—

"Curculio brevirostris albidus, elytris 4-spinosis, rostro fusco.

"Habitat ad Cap. B. Spei.

"Minor. Rostrum brevissimum, canaliculatum, fuscum. Thorax rotundatus, albidus, immaculatus, dorso plano. Elytra albida,

spinis quatuor erectis, validis, solitaria versus basin, duabus in medio e quarta versus apicem solitaria.

" Pedes albi, simplices."

Index of Species.

The numbers indicate the order in which the species are described. The names printed in italics are synonyms.

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Appendix.

Stramia, gen. nov.

Head suborbicular, continuous with rostrum, anteocular furrows absent; eyes subdepressed, elongate and transverse. *Rostrum* about as long as prothorax, comparatively slender, parallel-sided throughout or even slightly subulate; scrobes deep, straight and lateral, reaching the eye. *Antennæ* inserted near apex of rostrum, with the scape reaching about the middle of eye, sharply clavate and strongly curved; funicle with seven joints, 1 and 2 elongate, the former subcompressed and much broader than 2, 3–7 short and subequal; club elongate and acuminate. *Prothorax* transverse, its sides strongly rounded, the apical margin truncate, ocular lobes feeble, sometimes almost obsolete, base truncate or broadly rounded; upper surface convex and closely granulate throughout. *Elytra* ovate, about as broad as prothorax at base, apices jointly rounded, shoulders prominent, occasionally produced anteriorly into a sharp point; upper surface convex, shallowly punctato-striate, the intervals regularly granulate. *Abdomen* with segment 1 separated from 2 by a distinct curved suture, the latter longer than 2 or 3 separately, but shorter than the two together; intercoxal piece broadly rounded. *Legs* moderately long and stout, femora clavate, tibiæ simple, the anterior pairs slightly incurved at apex and finely serrate along their inner edge; tarsi spongy beneath, the 2nd joint shorter and narrower than 1st and 3rd, the latter deeply lobate; claws free.

The described species referable to this genus are *Tanyrrhynchus costirostris* Boh. (= *Hipporrhinus costirostris* Fåhr. = *Tan. laticollis* Fst.), *Hip. pygmæus* Gyl. (= *Tan. biguttatus* Boh. = *Tan.*

fahraei Fst.), *Hip. alternans* Fåhr., *Tan. ellipticus* Pasc., *Hip. bertinæ* Fst., and possibly some other species among the *Tanyrrhynchi* described by Boheman in which the femora are unarmed.

ORIGENES, gen. nov.

Head deeply set in prothorax, continuous with rostrum, anteocular furrows absent; eyes elongate, transverse and subdepressed, with their upper edge strongly elevated above the level of forehead. *Rostrum* as long as head and prothorax, curved and strongly dilated apically; scrobes deep and continued to beneath base of rostrum. *Antennæ* inserted near apex of rostrum; scape not reaching eye; funicle with seven joints, 1 and 2 longer than the others and of equal length, 3–7 short and subequal; club large, elongato-ovate. *Prothorax* transverse, sides rounded, base truncate, apex truncate dorsally and with very large ocular lobes upper surface tuberculate and with a broad central furrow. *Elytra* very short, ovate, apices jointly rounded in both sexes, shoulders roundedly prominent; upper surface convex, foveolato-sulcate, the intervals tuberculate. *Abdomen* with segment 2 about as long as 3 and 4 together and separated from 1 by a distinct curved suture; intercoxal piece broadly truncate. *Legs* rather short, femora slightly clavate, tibiæ simple, corbels of posterior pair broad and open; tarsi short, spongy beneath, joints of about the same width, 2nd and 3rd subequal, 1st longer; onychium rather elongate; claws free.

This genus, which was proposed by Mr. Péringuey, contains only one described species, viz. *Hipporrhinus callidus* Gyl.; but there are two or three undescribed species of similar facies which will probably have to be included in it.

EXPLANATION OF THE PLATES.

PLATE I.

Fig. 1. *Hipporrhinus oaxus*, p. 25.
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„ 3. „ *janus*, p. 36.
„ 4. „ *péringueyi*, p. 42.
„ 5. „ *angustus*, p. 40.
„ 6. „ *sparsus*, p. 45.
„ 7. „ *deceptor*, p. 44.
„ 8. „ *ciniger*, p. 44.
„ 9. „ *suturalis*, p. 46.
„ 10. „ *humeralis*, p. 57.

PLATE II.

Fig. 1. *Hipporrhinus nestor*, p. 58.
„ 2. „ *occidentalis*, p. 60.
„ 3. „ *fictilis*, p. 61.
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Fig. 1. *Hipporrhinus nyasæ*, p. 86.
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PLATE IV. [p. 117.

Fig. 1. *Hipporrhinus brachyceroides*,
„ 2. „ *gunningi*, p. 113.
„ 3. „ *incisirostris*, p. 115.
„ 4. „ *consors*, p. 121.
„ 5. „ *propinquus*, p. 123.
„ 6. „ *bimaculatus*, p. 126.
„ 7. „ *cervinus*, p. 127.
„ 8. „ *vicinus*, p. 126.
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„ 10. „ *incertus*, p. 128.

2. On proposed Additions to the accepted Systematic Characters of certain Mammals. By Dr. WALTER KIDD, F.Z.S.

[Received October 9, 1903.]

(Text-figure 3.)

There are certain modifications of the arrangement of hair in many groups of Mammals which seem to be of sufficient importance and constancy in regard to taxonomy to justify attention. Those which are here brought forward are the most prominent of their kind, but doubtless many others will also yield results under further examination. No attempt is made to interfere with accepted classification or to point out new affinities. Such observations as there are tend to support rather than to challenge the established views.

It is a fact that many different species have an arrangement of their hairy coverings which is quite characteristic, and certain genera, families, and orders also have their own plan, and within these groups individuals may vary slightly from the normal type of the group.

Two classes of phenomena are here chosen for a preliminary study. *First*, the arrangement of hair on the head and face, chiefly the naso-frontal region. *Second*, the distribution of whorls, feathering, and crests on the neck, trunk, and limbs.

I. *The Arrangement of Hair on the Head and Face.*

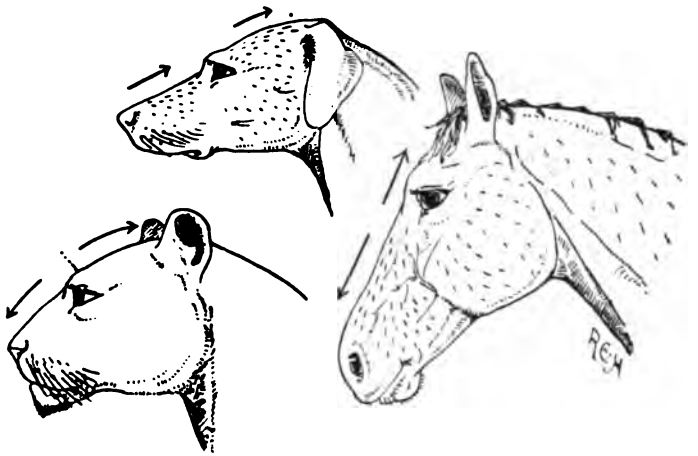
In the first place, there are two types of the arrangement of hair on the naso-frontal region. The hair may take that which seems to be the primitive course and pass from the premaxillary region, with slight modifications for different forms of skull, towards the frontal and parietal regions. This is well illustrated on the heads of Cervidæ and Canidæ, is far the more common arrangement, and is found in the largest groups. In many instances, as in Canidæ, there is found at the distal edge of the hairy portion of the muzzle a whorl, from which the stream of hair may be considered to take origin. In others, as in Cervidæ, the non-hairy portion of the muzzle is broader and extends further along the premaxillary region and no whorl is found. A totally different arrangement of the naso-frontal hair-streams is found in a smaller number of animal forms, all belonging to the Ungulate order, its best development being seen in the Domestic Horse. Here the starting-point of the stream is a whorl in the frontal area situated at, or just above, or below, the level of the orbits, from which two streams proceed, the larger and proximal one to the ears and neck, the smaller and distal one to the premaxillary region, diverging on each side of the face. The whorl on the frontal area thus divides the naso-frontal stream.

Under this type may be classed the arrangements of hair of

the Felidæ and Tapiridæ. In these two groups the frontal area shows the primitive direction, but at the base of the nasal bones or the level of the orbits a reversed slope of hair is found, and thus the nasal stream is directed towards the premaxillary region, starting in Tapiridæ from bilateral nasal whorls and in Felidæ without any whorl.

It is proposed to term these two leading types *Primitive* and *Derivative*.

Text-fig. 3.



Types of arrangement of Hair on the Naso-frontal Region of Canidæ (Primitive type) and Felidæ and Equidæ (Derivative type).

When the groups characterised by these two types are investigated, it is found that those with the Primitive type are marked off sharply from those with the Derivative arrangement by one fact, viz., that the former possess pointed snouts which they habitually carry high or in a direction approaching the horizontal, whereas the latter have larger and longer heads and carry them at an angle of somewhat less than 45° with the vertical line.

List of Animal Forms with Primitive type of arrangement of Naso-frontal Hair.

Marsupials.

Genus *Macropus*.
„ *Didelphys*.
„ *Thylacinus*
„ *Dasyurus*.
„ *Phalanger*.
„ *Perameles*.
„ *Peragale*.
„ *Tarsipes*.

INSECTIVORES.

Genus *Tupaia.*
„ *Macroscelides.*
„ *Gymnura.*
„ *Erinaceus.*
„ *Sorex.*
„ *Talpa* (slope of hair in *T. europæa* indifferent).
„ *Myogale.*

RODENTS.

Genus *Sciurus.*
„ *Mus.*
„ *Dasyprocta.*
„ *Castor.*
„ *Arctomys.*
„ *Fiber.*
„ *Pteromys.*
„ *Lepus.*
„ *Hystrix* (spines representing hair).

CARNIVORES.

Genus *Viverra*
„ *Genetta.*
„ *Herpestes*

„ *Lutra.*
„ *Mephitis.*
„ *Mustela.*
„ *Meles.*
„ *Putorius.*
„ *Gulo luscus.*

„ *Ursus.*

„ *Ælurus.*
„ *Procyon.*
„ *Nasua.*

„ *Canis* ... *C. vulpes.*
C. lupus.
C. aureus

UNGULATES.

SUIDÆ.

Genus *Sus.*
„ *Potamochœrus.*
„ *Phacochœrus.*
„ *Dicotyles.*

CAMELIDÆ.

Genus *Camelus.*
„ *Auchenia.*

TRAGULIDÆ.

Genus *Tragulus*.

GIRAFFIDÆ.

Genus *Giraffa*.

CERVIDÆ.

Genus *Moschus*.
„ *Cervulus*.
„ *Elaphodus*.
„ *Cervus*.
„ *Rangifer*.
„ *Alces*.
„ *Capreolus*.
„ *Pudua*.

BOVIDÆ.

Genus *Ovis*	*O. poli*	2
	O. sairensis	4
	O. ammon	2
	O. ophion	1
	O. argali	1
	O. nivicola	1
	O. canadensis	4
	O. vignei	2
	O. gmelini	1
	O. musimon	1
	O. tragelaphus	1
Genus *Capra*	*C. ibex*	2
	C. sibirica	2
	C. sinaitica	1
	C. walie	1
	C. pallasi	1
	C. ægagrus	3
Genus *Nemorhædus*	*N. bubalinus*	1
„ *Budorcas*	*B. taxicolor*	1
„ *Gazella*	*G. euchore*	3
	G. dorcas	1
	G. granti	2
	G. spekei	1
	G. subgutturosa	3
	G. thompsoni	1
	G. soemmerringi	1
	G. leptoceros	1
	G. arabica	1
	G. gerenuk	2
	G. muscatensis	2
Genus *Oreas*	*O. canna*	5
„ *Cervicapra*	*C. arundinum*	3
	C. fulvorufula	3
	C. thomasinæ	1

BOVIDÆ (*con.*).

Genus *Hippotragus*	...	*H. niger*	4
		H. equinus	2
„ *Kobus*	.....	*K. ellipsiprymnus*	2
		K. kob	2
		K. leche	2
		K. vardoni	1
		K. thomasi	2
		K. leucotis	1
		K. defassa	1
Genus *Strepsiceros*	.....	*S. kudu*	1
		S. imberbis	3
„ *Cephalophus*	...	*C. rufilata*	1
		C. sylvicultor	1
		C. natalensis	1
		C. grimmi	1
		C. abyssinicus	1
		C. doriæ	1
		C. jentinki	1

ANTILOCAPRIDÆ.

Genus *Antilocapra*	...	*A. americana*	1

List of Animal Forms with Derivative type of arrangement of Naso frontal Hair.

FELIDÆ.

Genus *Felis*	.....	*F. leo*	5
		F. tigris	7
		F. pardus	5
		F. concolor	1
		F. onca	1
		F. uncia	1
		F. lynx	1
		F. pardina	1
		F. isabellina	1
		F. nebulosa	1
		F. caracal	1
		F. pardalis	3
		F. canadensis	1
		F. caffra	1
		F. serval	1
		F. bengalensis	1
Genus *Cynelurus*	.....		1

PROCYONIDÆ.

Genus *Æluropus*	.....	*Æ. melanoleucus*	... 1

TAPIRIDÆ

Genus *Tapirus*	.....	*T. roulini.*	
		T. bairdi.	

EQUIDÆ.

Genus *Equus*	.....	*E. caballus.*	
		E. asinus (domestic).	**Mule.**
		E. asinus somalicus.	

EQUIDÆ (*con.*).

Genus *Equus*	*E. equuleus.*	
	E. hemionus.	
	E. onager.	
	E. zebra.	
	E. zebra burchelli.	
	E. zebra grevyi.	
	E. quagga.	

BOVIDÆ.

Genus *Bos*	*B. taurus*	Domestic, 20. Chillingham Wild Cattle, 1. Corean Bull, 1.
	B. gaurus	2
	B. sondaicus	1
	B. mindorensis	1
	B. caffer	2
	B. frontalis	1
	B. depressicornis	1
	B. bubalus	1
	B. indicus	1
	B. grunniens	1
	B. americanus	2
Genus *Ovibos*	*O. moschatus*	4
„ *Connochætes* ...	*C. taurinus*	3
	C. gnu	4
„ *Okapia*		1
„ *Addax*	*A. nasomaculatus* ...	1
„ *Saiga*	*S. tatarica*	1

II. *Whorls, Featherings, and Crests on the Neck, Trunk, and Limbs.*

Among the numerous modifications of the arrangement of hair found in Mammals in different species, whorls with their attendant featherings and crests are the most conspicuous. It is here proposed to enumerate those among them which exhibit the greatest degree of definition, and to suggest that some or all of them should be dealt with in the description of the species and genera in which they are found. It is not necessary here to enter into the theory of the origin of these phenomena or their interpretation, but only to take them as they are found on the pelage of hair-clad mammals and to show their taxonomic value. Among the large number of these phenomena found in various groups, many are casual in their appearance, rudimentary, and uncertain. But there are many the development of which is completed, and these constitute the class here considered. Wide investigation of them brings out the fact that a whorl is in process of further development, *under conditions favourable to that development.* Thus a whorl found alone may be looked upon as about to be projected into a feathering, and a whorl and feathering found together as about to be terminated, in a later stage, by a ridge or crest, which

marks the obstacle, whatever it be, to the onward progress of the feathering. Thus can one explain the fact that on the hairy coverings of a very large collection of animal forms various gradations are found, such as whorls alone, whorls and featherings alone, and whorls, featherings, and crests.

It is a fact worth noting, whatever the meaning of it may be, that the animal which most of all exhibits these phenomena, both as to variety and number, is *Equus caballus*. It may fairly be taken for granted that many of these arrangements of hair are fully evolved, and that others, both in wild and domesticated forms, are in process of development. It may be permitted here to use a geological term applied to a river-bed, and to say that the former have attained their "regimen" and that the latter are on their way to that result. Evidence for most of these statements is to be found in three papers published in the 'Proceedings' on kindred subjects*.

Whorls, featherings, and crests are found in ten different regions—the Premaxillary, Nasal, Frontal, Cervical, Spinal, Pectoral, Axillary, Inguinal, Gluteal, and Temporal. For the sake of brevity these are indicated in the following list as follows: Pr. N. F. C. S. Pe. A. I. G. T. Of these ten, T and G are rare and of apparently little value to taxonomy.

In addition to the primary or major whorls which are held to be characteristic of certain groups, some subordinate and common instances are given in the list; the former are indicated in ordinary, and the latter in *italic* type.

No mammalian *Order* has been found possessing characteristic whorls, featherings, and crests.

Whorls characteristic of the following groups are indicated by capitals as previously described:—

Procyonidæ.

Eluropus melanoleucus. N ... 1

Cervidæ. Pe *C*.

Genus *Moschus*.
„ *Cervulus*.
„ *Elaphodus*.
„ *Cervus*.
„ *Rangifer*.
„ *Alces*.
„ *Capreolus*.
„ *Pudua*.

Equidæ. F *C Pe A I G*.

Equus caballus. 100 examined in addition to a very large series observed.
E. asinus (domestic) 20
Mule 20

No exception to this characteristic F has been found in any Equidæ except the Domestic Ass, in which the whorl is changed in position and lies over the nasal bones.

* P. Z. S. 1900, p. 676; 1902, vol. ii. p. 145; 1903, vol. i. p. 79.

EQUIDÆ (*con.*).

E. asinus somalicus ... 1
E. equuleus 5
E. hemionus 2
E. onager 2
E. zebra 2
E. zebra burchelli 5
E. zebra grevyi 3
E. quagga 1

GIRAFFIDÆ. Pr C.

Genus *Giraffa*.

SUIDÆ. Pr.

Genus *Sus*.
„ *Potamochœrus*.
„ *Phacochœrus*.
„ *Dicotyles*.

TAPIRIDÆ. N.

Genus *Tapirus*.

BOVIDÆ.

Genera:—*Bos*. F *C S Pe A I T*.

B. taurus ..... { Domestic, 20. Chillingham Wild Cattle, 1. Corean Bull, 1.
B. gaurus 2
B. sondaicus 1
B. mindorensis 1
B. caffer 2
B. frontalis 1
B. depressicornis 1
B. bubalus 1
B. indicus 1
B. grunniens 1
B. americanus 2
Ovibos moschatus 4

Kobus. S Pe.

K. ellipsipyrmnus 2
K. kob 2
K. leche 2
K. vardoni 1
K. thomasi 2
K. leucotis 1
K. defassa 1

Connochætes. N.

C. taurina 3
C. gnu 4

BOVIDÆ (*con.*).

Species:—*Oryx beisa*. F 3
Oryx gazella. F..... 2 young specimens
Addax nasomaculatus. F..... 1
Saiga tatarica. N 1

Genus *Equus*.
E. caballus. F *C* PE I *A G* { 100 examined specially in addition to a very large series observed.
E. asinus (domestic) N *PE I* ... 20
Mule. N PE I 20
E. equuleus. F PE I 5
E. asinus somalicus. F 1
E. hemionus. F *A* I 2
E. onager. F *A* I 2
E. zebra. F *C* 2
E. zebra burchelli. F *A C*..... 5
E. zebra grevyi. F *C*..... 3
E. quagga. F 1

3. Some Observations on the Skull of the Giraffe. By W. G. RIDEWOOD, D.Sc., F.L.S., F.Z.S., Lecturer on Biology at the Medical School of St. Mary's Hospital.

[Received November 30, 1903.]

(Text-figures 4–10.)

Since the time of Blumenbach * it has been known that the paired horns of the Giraffe are formed in the young as separate bony columns or "epiphyses," which later fuse with the almost smooth upper surface of the cranium; and shortly before the publication of his memoir on the Okapi † Prof E. Ray Lankester learnt that a skin of the Okapi had arrived at Brussels with the paired horns, or, as he proposes to call them, the "ossicusps," separable from the skull ‡. A few weeks prior to the latter discovery Prof. Lankester had caused a section to be made lengthwise down one of the horns of the skull of a well-grown male Giraffe §, with the object of ascertaining to what extent the suture between the bony pillar and the cranial roof might remain visible. So far as the suture was concerned, the result was a little disappointing, but the section showed that the great fronto-parietal sinuses extend upwards into the bases of the horns (as described

* Handb. d. vergl. Anatomie, Göttingen, 1805, p. 36, footnote.

† Trans. Zool. Soc. xvi. 6, 1902.

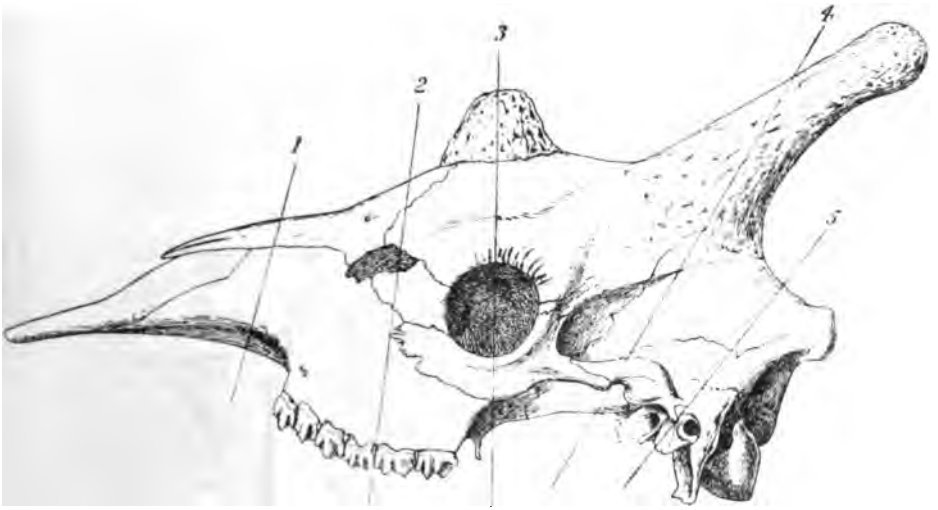
‡ The matter is referred to in an appendix, dated May 27th, to Prof. Lankester's memoir, pp. 305 & 306. The ossicusps were described by Dr. Forsyth Major in 'La Belgique Coloniale,' Nov. 9th, 1902, p. 533, and are again alluded to in his paper in the Proc. Zool. Soc. 1902, ii. p. 344.

§ Brit. Mus. Register No. 1.8.9.48. Presented by Sir Harry Johnston, K.C.B. Locality—Guas Ngishu Plateau, E. of Mt. Elgon, Brit. E. Africa.

in a footnote, dated April 30th, on p. 295 of the above-mentioned memoir), and suggested that either the base of the primary horn or ossicusp must have been hollowed out by the absorption of its substance as the sinus extended upwards, or that the primary ossicusp must have been lifted up bodily upon a hollow dome or cone of the fronto-parietal bone, while a corresponding downgrowth of bone occurred from the margin of the ossicusp so as to cover up the lower parts of this conical eminence. On the former assumption the layer of bone which in text-fig. 9 (p. 155) forms the boundary of the uppermost part of the fronto-parietal vacuity would belong to the ossicusp, and on the latter to the fronto-parietal bone. So much of the suture as can be recognised in the section certainly rises so as to run parallel to the margin of the sinus, and the lamination and the density of the bone that forms the immediate boundary of the vacuity also favour the second view.

Desiring to know more about the relations of the great fronto-parietal sinuses, Prof. Lankester had the skull cut across into six

Text-fig. 4.

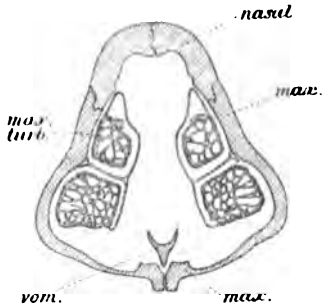


Skull of Giraffe, left side; key-figure, a little larger than one-sixth (linear) of the natural size, showing the directions in which the skull was cut.

pieces along planes which he indicated, and the inclinations of which are shown in text-fig. 4 by the lines 1—5. The appearances presented by these sections being new to science, and the sections promising to prove of greater interest in proportion as more knowledge is obtained of the skull of the Okapi, Prof. Lankester had drawings made, which he handed over to me with a request that I should write a short description of them for publication. My thanks are hereby tendered to Prof. Lankester for the use of the drawings.

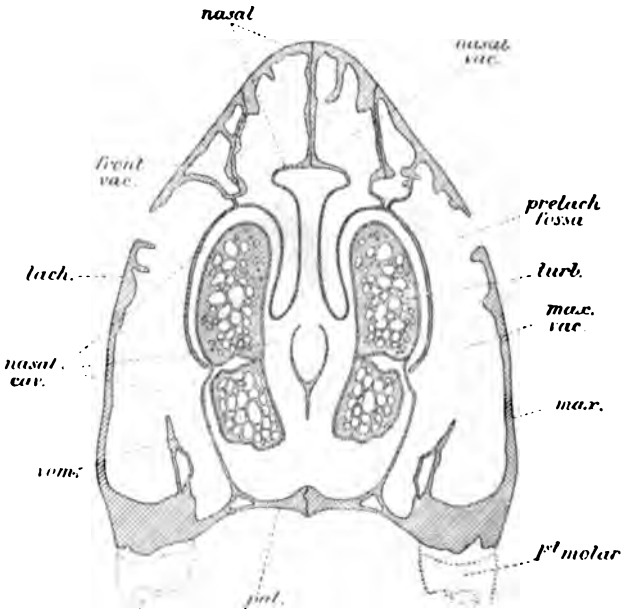
As a matter of fact, the figures explain themselves so well that only a very brief description of them is necessary. The first plane

Text-fig. 5.



Outline sketch of a section through the nasal region, taken in the direction of the line 1 in text-fig. 4. One-third (linear) of the natural size.

Text-fig. 6.



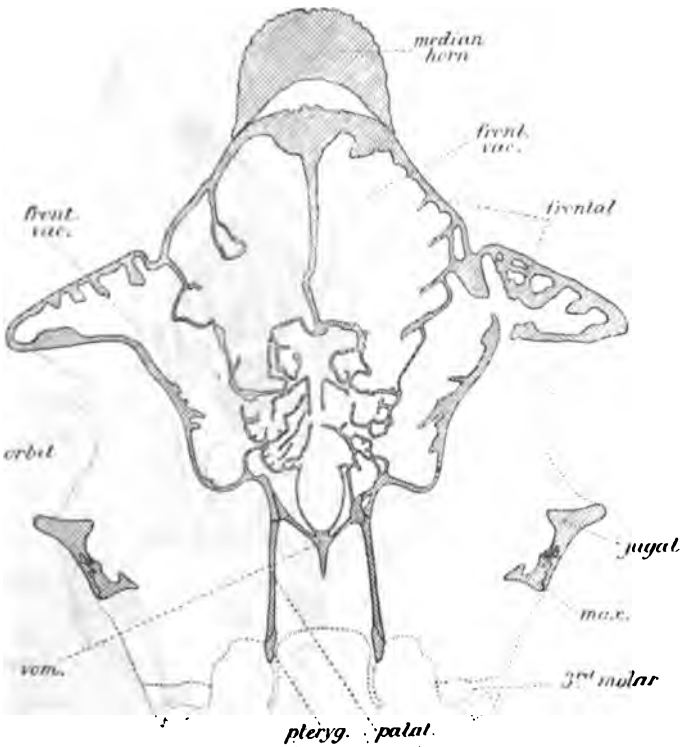
Outline sketch of the view, looking forwards, of the skull cut through the prelachrymal vacuity in the direction of the line 2 in text-fig. 4. One-third (linear) of the natural size.

of section, indicated by line 1 in text-fig. 4 (p. 151), passes nearly transversely through the nasal region of the skull, slightly in

advance of the cheek-teeth, and the view obtained is shown in text-fig. 5 (p. 152). The whole of the bony envelope is formed by the two nasals, which meet in the middle line above, and the maxillæ, which meet one another below. The maxillo-turbinals are cut through, and the front part of the vomer is also included in the section.

The section shown in text-fig. 6 (p. 152) is taken through the prelachrymal vacuity or fossa, as shown by line 2 in text-fig. 4 (p. 151), and passes between the first and second molar teeth of each side. The vacuities in the nasal bones are large, and the two nasal bones

Text-fig. 7.

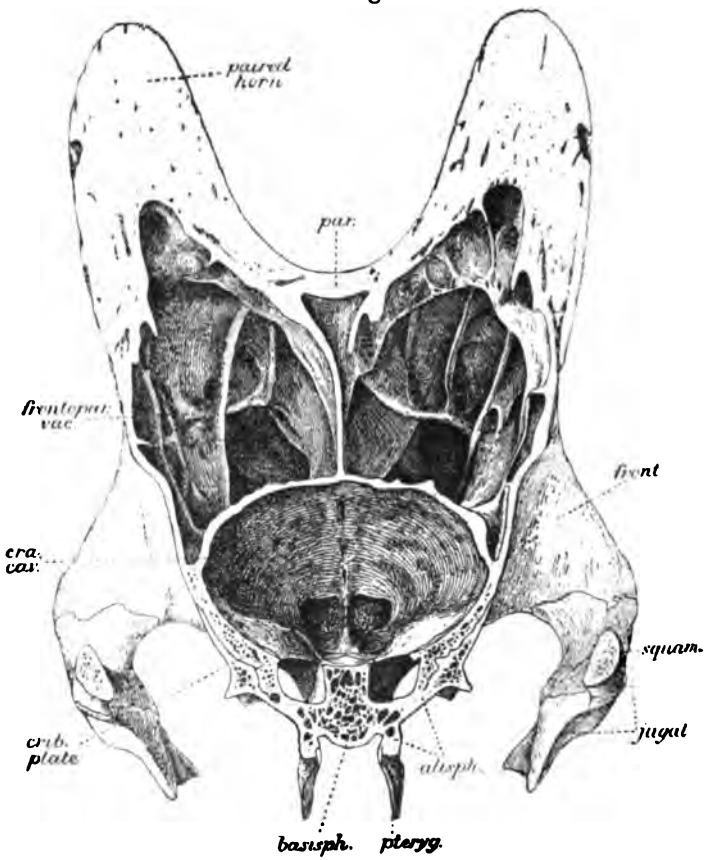


Outline sketch of the view, looking forwards, of the skull cut through the median horn and through the middle of the orbit, as shown by the line 3 in text-fig. 4. One-third (linear) of the natural size.

are in extensive contact in the median plane of the head, so that the sagittal suture is of considerable vertical height; the sutures between the nasals and the frontals are equally extensive. The extreme anterior ends of the frontal vacuities are included in the section. The maxillary sinuses in the dried skull open laterally

by the prelachrymal apertures, and except in their lower parts show very little in the way of internal partitions. The two nasal cavities appear as one large single cavity, presumably owing to the septum nasi being unossified, and, therefore, missing in the dried skull. The vomer in this region has the form of a deep trough with a sharp keel below, and presents a Y-shaped section, situated some distance above the palatine bones. The turbinal bones seen are the posterior parts of the maxillo-turbinals.

Text-fig. 8.

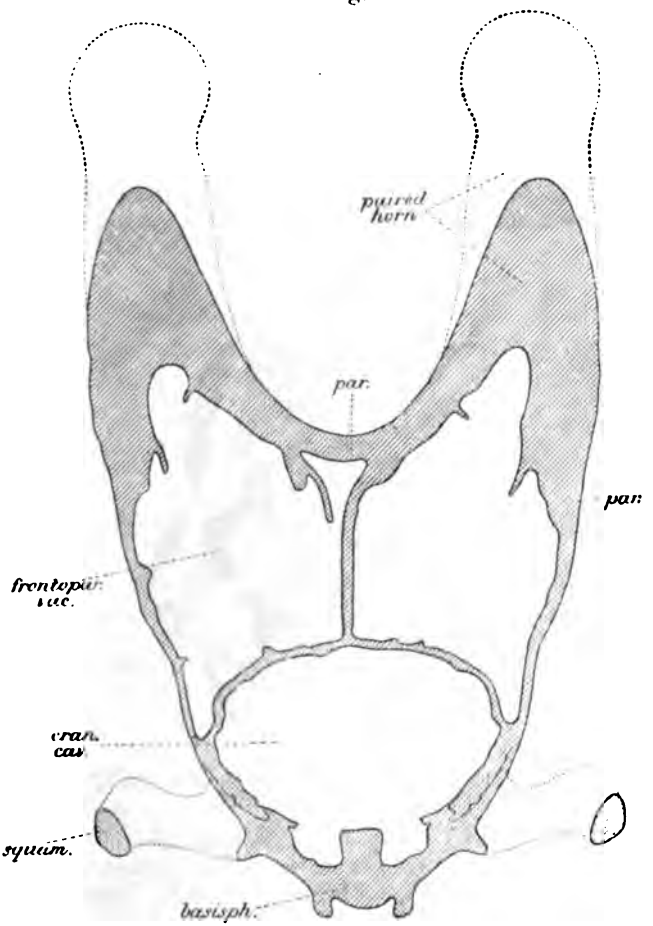


View, looking forwards, of the skull cut in the direction of the line 4 in text-fig. 4. One-third (linear) of the natural size.

The section shown in text-fig. 7 (p. 153) is taken through the middle of the orbit and through the median horn (see line 3 in text-fig. 4, p. 151). The view taken is that looking forward, so that the third molar teeth, the hamular processes of the pterygoid bones,

and the anterior margins of the orbits are seen in the distance. Although in some Giraffes the median horn is fused with the frontal bones, in the skull under consideration it is separable, and its under surface is very concave considering the convexity of the upper surface of the frontal bones upon which it is set.

Text-fig. 9.



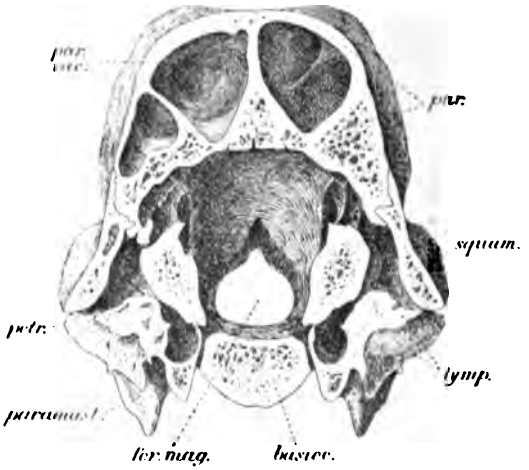
Outline sketch of the view, looking backwards, of the skull cut in the direction of the line 4 in text-fig. 4. One-third (linear) of the natural size.

The frontal vacuity on each side is large, and is divided into a more central part and a more lateral or supra-orbital part by a fenestrated partition. Both cavities communicate by means of fenestræ in the bony partitions with the hinder part of the nasal cavity,

which is largely filled up by the ethmo-turbinal bones shown in the centre of text-fig. 7 (p. 153). As in the two previous figures, the vomer exhibits a trough on its upper surface; its lateral projections enter into relation with the lowermost parts of the frontal bones as well as with the upper edges of the palatines. A small process of the maxilla extends backwards along the inner face of the jugal, and this process, although concealed by the jugal bone in text-fig. 4, is seen in section in text-fig. 7.

Two views are given of the skull cut in the direction of the line 4 in text-fig. 4, one (text-fig. 8, p. 154) looking forward, and the other (text-fig. 9, p. 155) looking backward. The plane of section passes obliquely down the front part of the paired horns, so as to include the summit of the fronto-parietal vacuity on each side. In text-fig. 8 are seen the bony partitions that incompletely divide the great fronto-parietal sinuses, and it will be noticed that these partitions are unsymmetrically disposed on the two sides. The

Text-fig. 10.



View, looking backwards, of the skull cut in the direction of the line 5 in text-fig. 4. One-third (linear) of the natural size.

relatively small cranial cavity shows the cribriform plates in the distance. The section passes through the basisphenoid and alisphenoid bones, and the pterygoid bones (not their hamular processes) are seen in the distance flanking the inner surfaces of the lower wings of the alisphenoid bones. The zygomatic process of the squamosal is cut immediately behind the hindermost part of the jugal, but in the distance the jugal is seen rising behind the orbit to enter into extensive sutural connection with the post-orbital process of the frontal. The backward view seen in text-fig. 9 (p. 155) differs from the forward view of text-fig. 8 (p. 154) only in that in the distance are seen the upper parts of the paired

horns, and the glenoid portion of the zygomatic process of the squamosal bone on each side.

The great vacuity beneath each of the paired horns occurs in both frontal and parietal bones *, but in the hinder part of the skull the cavity becomes smaller, and may be termed the parietal vacuity, since it occupies the parietal bone only. The internal incomplete partitions are not symmetrical, and the vacuity as a whole is greater in the right side of the skull than in the left. The view shown in text-fig. 10 (p. 156) is obtained by taking a section parallel to the occipital surface of the skull, behind the paired horns and just in front of the tympanic orifices: the direction of section is shown by the line 5 in text-fig. 4 (p. 151). The basioccipital bone is cut through, as also are the petrous portion of the periotic bone of each side, the tympanic cavity, and the part of the squamosal bone that lies behind the zygomatic process. In the distance are seen the foramen magnum and the paramastoid processes.

4. Note on the Brains of the Potto (*Perodicticus potto*) and the Slow Loris (*Nycticebus tardigradus*), with some Observations upon the Arteries of the Brain in certain Primates. By FRANK E. BEDDARD, M.A., F.R.S., Prosector to the Society.

[Received January 12, 1904.]

(Text-figures 11–14.)

Since my description of the brain of these two species of Lemurs †, the subject has received attention at the hands of Prof. Ziehen ‡, of Dr. Elliot Smith §, and of others ‖. Dr. Elliot Smith has treated of the Lemur brain exhaustively and has fully described both *Nycticebus* and *Perodicticus*. As, however, so very few brains of both of these Lemurs have been examined by anatomists, I do not think it unnecessary again to fix the attention

* The base of the horn rides equally, so far as can be judged from the specimen under consideration, on the parietal and frontal bones, and a statement to the same effect is made by Owen in his 'Anatomy of Vertebrates' (ii. p. 476, and iii. p. 627). In the young, however, the relations are different; for Owen (Trans. Zool. Soc. iii. 1 [1842], p. 26) describes the separable epiphyses of a very young Giraffe as set upon the frontal bones, while Lankester (Trans. Zool. Soc. xvi. 6, 1902, p. 293) figures a skull, apparently not much older, in which the parietal bone of each side is markedly domed, and supports the horn. The specimen of which Owen made use is still preserved in the Museum of the Royal College of Surgeons, but the whole of the fronto-parietal region has been cut away, so that it now gives no evidence on the subject. Whether the paired ossicusps of the Giraffe originate in relation to the frontal or to the parietal bones can only be determined by the examination of new specimens of new-born individuals.

† "On the Brain in the Lemurs," P. Z. S. 1895, p. 142.

‡ "Ueber die Grosshirnfurchung der Halbaffen, &c.," Arch. f. Psychiatrie, xxviii. 1896, p. 898.

§ Cat. Phys. Ser. Royal Coll. Surg. vol. ii. (2nd ed.), 1902, and "On the Morphology of the Brain in the Mammalia, &c.," Trans. Linn. Soc., 2nd ser. Zool. viii. (1903) p. 319.

‖ See references below, p. 158.

of students of the brain upon these Lemurs, since I have two new brains of *Nycticebus* and one of *Perodicticus* to report upon, none of which has been studied by any other person.

Of *Nycticebus tardigradus* eight brains * altogether have been examined, one by Sir William Flower †, one by myself ‡, four by Ziehen §, one by Chudziaski ||, and one by Flatau and Jacobsohn ¶.

The measurements of the cerebral hemispheres of my two new brains are as follows:—

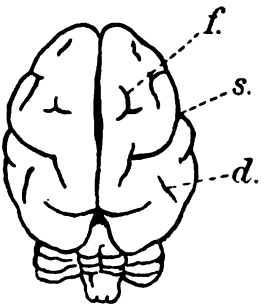
A. Length 30 mm., greatest diameter 26 mm., height 20 mm.
B. „ 26 mm., „ „ 26 mm., „ 19 mm.

I could detect no trace whatsoever of a distinction between an upper supra-Sylvian sulcus and a lower pseudo-Sylvian sulcus such as Dr. Elliot Smith describes and figures; nor could I see the little forwardly projecting end of the Sylvian which he figures in the lateral view of the brain. I observed in my brain A (the larger of the two) that at the point where the Sylvian sulcus becomes continuous with the lateral sulcus, the latter has a minute forwardly directed continuation, which may be considered to represent the anterior half of this fissure in *Perodicticus*; and I may call attention to the interesting fact that Dr. Elliot Smith has himself figured in the Potto ** a feeble union between the Sylvian and the lateral fissures. The lateral fissure exhibits a slight difference in direction in the two brains which I have studied. In the smaller one the two fissures are distinctly more parallel to each other and therefore to the interhemispheral sulcus. In regard to the relations between the lateral sulcus and the post-lateral (= my "parieto-occipital") Dr. Elliot Smith writes:—"It is interesting to note in these two casts [of the brain-cavity of *Nycticebus*] that there is a definite post-lateral sulcus in all four hemispheres, and in none of them is the caudal extremity of the lateral sulcus bent inward, as is invariably the case when the separate post-lateral sulcus is absent. A comparison of the brain-case of my type specimen with the other cranium from Ghizeh shows that the separate post-lateral sulcus occupies the same position in regard to the skull as the mesially bent end of the lateral sulcus of the other specimen" ††. In the two brains examined by myself and reported upon here, the caudal extremity of the lateral sulcus is bent inwards (more in one brain than in the other) and the post-lateral sulcus is well developed. In both brains the sulci are developed on both sides, and they just dip over the inter-hemispheral margin lying there midway between the two parts of the calcarine fissure. The fissure which Dr. Elliot Smith letters "*f*" is bracket-shaped in the smaller of my two brains, which appears

* One of these has been described both by Ziehen and by Elliot Smith.
† "On the Brain of the Javan Loris," Tr. Z. S. vol. v. p. 103.
‡ *Loc. cit.* p. 144. § *Loc. cit.* p. 902.
|| Bull. Soc. d'Anthr. 1895, p. 436.
¶ Handbuch d. Anatomie . . . . d. Centralnervensystems d. Säugethiere, Berlin, 1899.
** Cat. Phys. Ser. Royal Coll. Surg. p. 378, fig. 220.
†† Trans. Linn. Soc. *loc. cit.* p. 343.

to be its typical form. It is quite different in the other, and the difference is not without interest. As will be observed in the accompanying drawing (text-fig. 11, *f*), the furrow in question is really two furrows, one transverse, the other longitudinal, arranged triradiately. I think it not unreasonable to regard the transverse

Text-fig. 11.



Dorsal aspect of brain of *Nycticebus tardigradus*.

d., see description in text; *f.*, fissure of Rolando; *s.*, Sylvian fissure.

portion as the fissure of Rolando (Sulcus centralis), and the conditions observable are distinctly more like those of the Potto (see later, p. 160). These new facts account also, it will be observed, for the somewhat anomalous bracket-like form of the fissure "*f.*" In both specimens and on both sides there was a small but very clearly marked furrow (*d*, text-fig. 11) running across the interval between the post-Sylvian and the post-lateral, and as nearly as possible at right angles to both. Its direction is the same in both specimens.

Text-fig. 12.

Lateral view of brain of *Nycticebus tardigradus*.

Letters as in text-fig. 11.

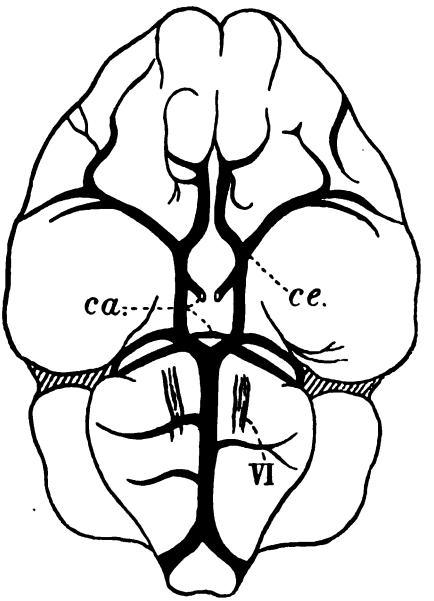
Of *Perodicticus potto* fewer brains have been examined than of *Nycticebus*, apparently only four, of which but two have been figured, that described by myself and that described by both Ziehen and Elliot Smith. One matter of interest that I am able to record is the existence of a shallow depression traversed by a blood-vessel, which seems to me to correspond to the post-lateral sulcus of *Nycticebus*. Dr. Elliot Smith thinks that the sulcus

which he letters "*sce.*," and believes to correspond to the fissure of Rolando, is "obviously formed by a blending of the sulcus *f* of the Lemurs with a sulcus such as I called *x* in *Nycticebus*." That fissure ("*sce.*") is plainly visible in my specimen. I am, however, a little inclined to complain of the word "obvious" in Dr. Elliot Smith's phrase, and to amend his conclusion as to homologies by suggesting that the fissure "*sce.*" of *Perodicticus* is formed by a blending of "*x*" with the transversely running portion of the fissure "*f*."

Arteries of Brain.

I have been able to compare injected brains of the Potto, *Lemur coronatus*, and a young *Lemur macaco* with those of a few species of Apes. I have amassed a considerable number of injected brains

Text-fig. 13.



Base of brain of *Perodicticus potto*.

ca., additional posterior communicating artery; *ca.* points to both carotid and commissural artery uniting branches of basilar artery; *ce.*, junction of middle and anterior cerebrals; VI, sixth nerve.

of various mammals which I find to present certain differences in the arrangement of the arteries. For the present, however, I confine myself to noting the arrangement of the arteries in a few Primates with special reference to the Lemurs. Tandler has studied these arteries in a few Primates (besides other mammals), but not in the species studied by myself. He figures *Lemur*

varius *, which seems to resemble the two species of that genus examined by myself in the early union of the anterior cerebrals. In the first place, there is some variability in the length of the basilar artery; I mean, of course, in proportion to the size of the brain. Now the brains of the Potto, the *Lemur*, and *Midas rosalia* are approximately of the same size, the Potto being if anything the smallest of the series. The basilar artery measures in these types in the order given 13 mm., 7 mm., 6 mm. The discrepancy is too great to allow of a possible error in measurement at all serious. The increase in length is naturally of the artery alone, as is shown by taking as fixed points the origins of the third and sixth nerves. I find that the length of the basilar artery in *Lemur* is proportionately equivalent to that of the same artery in *Macacus nemestrinus*, *Cercocebus collaris* and *C. fuliginosus*, *Mycetes seniculus*, as well as *Midas rosalia*. I may further remark that a *long* basilar artery is found in the Carnivora and Rodentia. The basilar artery gives off, at any rate in the Primates, two cerebellar arteries, of which one is quite anterior and the other arises not far from the union of the two vertebrals to form the basilar. The figures in Gray's 'Anatomy' (10th ed.) and Quain's 'Anatomy' (8th ed.) show the middle cerebellar artery (="anterior inferior cerebellar artery") arising in front of the origin of the sixth nerve. I find that in all the Monkeys mentioned and in the Lemurs the artery in question arises *behind* the sixth nerve.

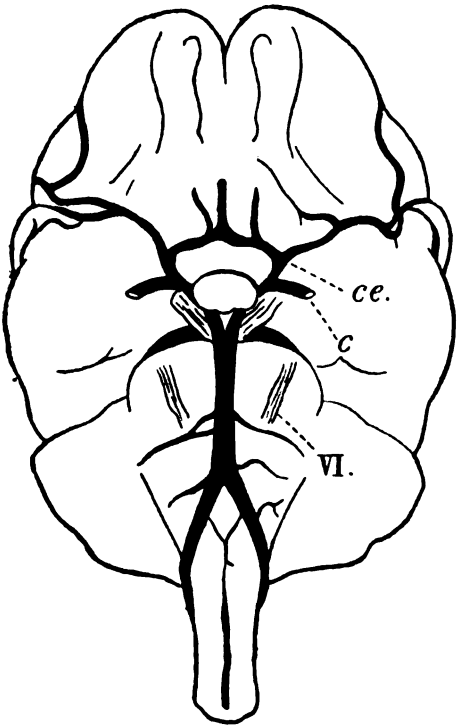
The circle of Willis is not precisely identical in the two Lemurs. In the Potto the basilar artery divides into only two branches at the anterior end, which continue for the space of about 2 mm. without dividing. It bifurcates just before reaching the third nerve into the anterior cerebellar and the posterior cerebral arteries. The two posterior cerebral arteries are connected by a commissure in front of the end of the basilar artery. The posterior communicating artery has not the exact relations to the carotid that it has in Man. In Man, the carotid reaches the circle of Willis just at the optic chiasma, and divides at once into three branches, viz., the anterior and middle cerebrals, and the posterior communicating artery. In the Potto, the carotid reaches the circle of Willis *behind* the origins of the anterior and middle cerebral arteries and, as it were, along the course of the posterior communicating artery. The anterior cerebral artery of one side closely approaches its fellow of the opposite side before they turn over the end of the brain and run along over the surface of the corpus callosum. There is, however, no anterior communicating artery at all; but the two anterior cerebrals fuse into one on the upper surface of the corpus callosum to separate again later. The arrangement in fact is precisely that of *Macacus nemestrinus*.

In *Lemur macaco* there are differences. The basilar artery gives off on either side a slender anterior cerebellar artery before

* "Zur vergleichenden Anatomie der Kopfarterien bei den Mammalia," Denkschr. k. Akad. Wien, lxvii. 1899, p. 677.

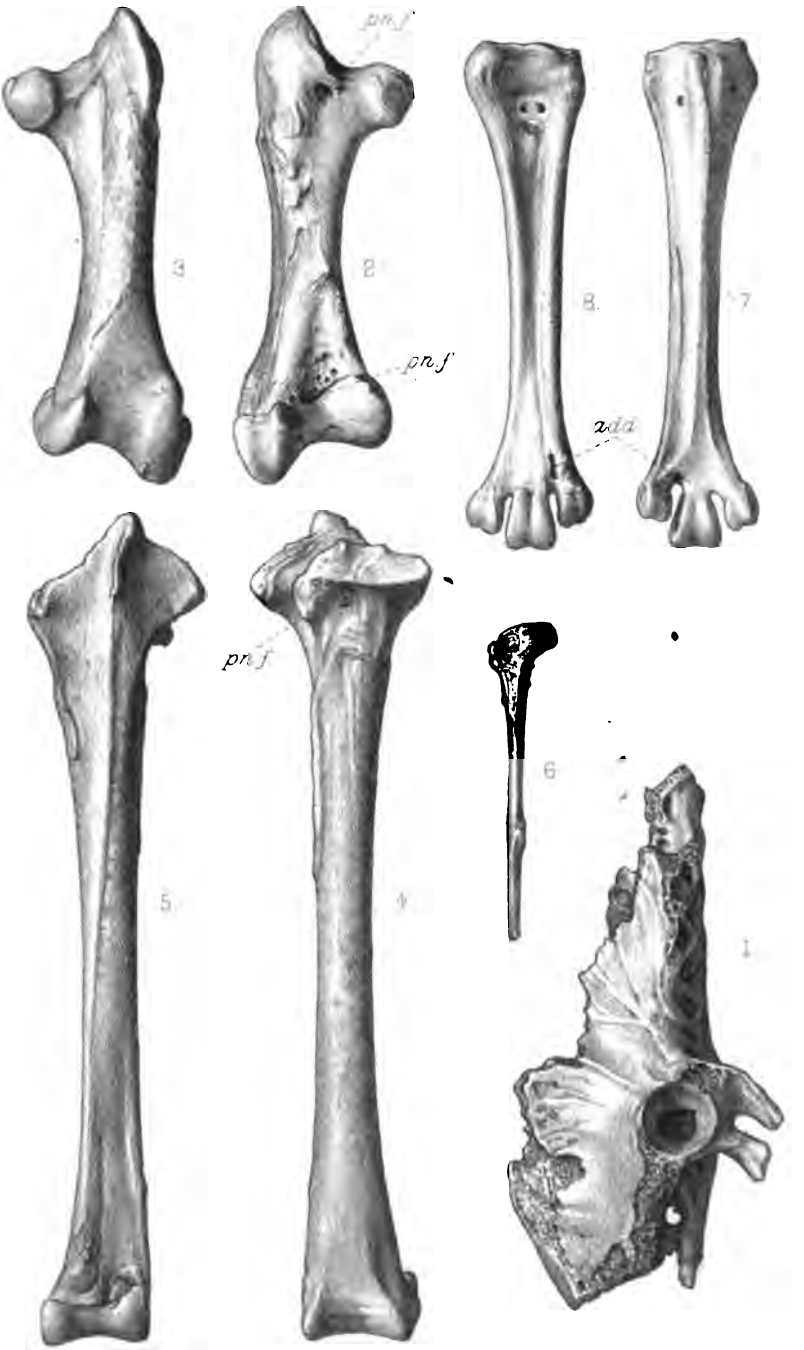
dividing into the two very stout posterior cerebrals. The disproportion between these arteries is very marked; in the Potto they are of about the same size. The posterior communicating artery is much thicker than the posterior cerebral from which it arises. It communicates, in the same way as in the Potto, with the carotid considerably behind the point where the latter divides into the middle and anterior cerebral arteries. Anteriorly there is a stout anterior communicating artery, from which arises the, at first, single anterior cerebral; two fused anterior cerebrals only join for a brief space in the centre of the corpus callosum, separating again almost immediately.

Text-fig. 14.



Base of brain of *Lemur macaco*.
c, carotid. Other letters as in text-fig. 13.

Lemur coronatus resembles *L. macaco*; for the two anterior cerebrals just before they disappear into the interhemispheral fissure become fused, and after a short space of union separate again. There is thus, as in *L. macaco*, a more or less prolonged union between the two anterior cerebrals instead of a short bridge



G. M. Woodward, del. et lith.

West, Newman imp. London

Bones of Mullerornis betsilei

as in Man, but not so lasting a union between the anterior cerebrals as in the Potto. Finally it may be noted that while in the two species of *Lemur* the union of the two anterior cerebellar arteries takes place just in front of the optic chiasma and also at right angles to the subsequent course, thus resembling the anterior communicating artery of Man, the junction of the same two arteries in the Potto is invisible until the hemispheres are separated, and is thus oblique, as it is in such Monkeys, Rodents, and Carnivora that I have been able to examine.

5. On the Pelvis and Hind-limb of *Mullerornis betsilei* M.-Edw. & Grand.; with a Note on the Occurrence of a Ratite Bird in the Upper Eocene Beds of the Fayum, Egypt. By C. W. Andrews, D.Sc., F.Z.S. (British Museum, Natural History).

[Received January 14, 1904.]

(Plate V.* and Text-figure 15.)

Among the numerous bird-remains brought back from Central Madagascar by Dr. Forsyth Major are some beautifully preserved bones of the pelvis and left hind-limb of a small ratite bird referable to the genus *Mullerornis* of Milne-Edwards and Grandidier †. The femur, tibio-tarsus, fibula, and tarso-metatarsus, as well as a considerable portion of the pelvis, were found in natural association, but none of the phalanges were preserved. No detailed description of any member of the genus having ever been published, a brief account of these specimens may be welcome. It may be said at once that these bones differ in no very striking manner from those of *Æpyornis*, and that they do not appear to throw any further light on the affinities of the Æpyornithidæ as a whole.

Of the three species of *Mullerornis* distinguished by Milne-Edwards and Grandidier, the bird in question agrees very nearly (in its dimensions) with *M. betsilei*, and since, moreover, it is from the same locality, it may be regarded as belonging to that species.

The Pelvis (Plate V. fig. 1).—The pelvis, which seems to have been very long and narrow, is very badly preserved; of the ilia the only portion in a tolerably perfect condition includes the acetabular region and a short distance behind it, while the pubes and ischia are represented by mere stumps only. In the preacetabular region of the pelvis the upper edges of the ilia must have united to form a strong iliac crest; just over the antitrochanter they diverge, forming the supra-trochanteric crests which constitute the anterior boundaries of the pelvic escutcheon, of which in the

* For explanation of the Plate, see p. 171.

† Comptes Rendus, t. cxviii. 1894, p. 125.

present specimen only the anterior end is preserved. The synsacrum is represented by about fourteen vertebræ. The acetabulum is large and nearly circular in outline; its ventral border lies above the ventral surface of the synsacrum. The acetabular foramen is a large, roughly triangular opening through which the arches of the vertebræ of that region can be seen: the antitrochanter is very large. The region of the pectineal process is much abraded. Only the proximal portions of the ischia and pubes are preserved; they are intimately fused with the centra of the synsacral vertebræ, which, as described below, there form a ventral prominence. There is no very definite ridge uniting the two ischia across the synsacrum as in some specimens of the pelvis of *Æpyornis*, and therefore the postsacral furrow of Burckhardt is scarcely at all developed.

In the syncracum there are eleven or twelve vertebræ in front of the true sacrals. Of these the seven anterior lie in front of the acetabulum and the point of origin of the pubes; the other four or five are crowded together between the acetabula, and are so closely fused with one another that they can only be distinguished from one another by the foramina perforating their fused arches.

The first synsacral bears a facet for a rib-head, situated on the side of the centrum close to the anterior articular surface: the transverse process has been broken away. The base of the neural arch is excavated by a deep pocket-like fossa. The neural spine is broken away to a great extent, but it can be seen that its base was strengthened by six buttress-like lamellæ of bone, of which two are placed longitudinally, two others run outwards and a little forwards on to the transverse processes; the two remaining ridges run midway between the last-mentioned plates and the postero-median one. There is a small hypapophysis situated immediately behind the anterior surface of the centrum.

The second vertebra has a broad transverse process the base of which is excavated by a large pneumatic fossa divided into two chambers by a vertical lamella of bone. There seem to have been no articular surfaces for ribs, but the bone is somewhat incomplete where they should occur. There is a very slightly marked hypapophysis on the front of the ventral surface. The next vertebra is similar except that there is no trace of a hypapophysis. In the next the transverse process is smaller and more backwardly directed, but it is not, as in *Æpyornis*, divided into a dorsal and ventral bar. This division, however, occurs in the next (5), in which the ventral bar is small and forwardly directed. The same is the case in the following two (6 and 7). In none of these hinder vertebræ (3-7) is there any hypapophysis. The outer ends of the parapophyses, which are separated by oval foramina, are intimately united with the ilia.

The centra of the eighth to the eleventh (or twelfth) vertebræ are fused with one another and with the proximal portions of the pubes and ischia. The united centra form a ventral prominence

convex antero-posteriorly, but this projection is not bounded posteriorly by a well-marked groove as in *Æpyornis*. The centra of the succeeding (post-acetabular) vertebræ do not run in quite the same straight line as those in front, but slope somewhat upwards, so that the preacetabular region of the synsacrum makes a slight angle with the post-acetabular, the two being separated by the ventral prominence of the inter-acetabular centra.

In the thirteenth, fourteenth, and fifteenth vertebræ there are ventral processes, of which the anterior two are perhaps to be regarded as the true sacral ribs; the outer ends of these processes unite externally into a common mass which abuts on the ilium immediately behind the acetabulum, and at the same time forms the hinder wall of the cavum acetabulare. Of these processes, that of the thirteenth vertebra is slender and directed backwards, that of the fourteenth stouter and running directly outwards, that of the fifteenth much the largest and directed forwards; the centra of these three vertebræ are flat below.

The sixteenth vertebra bears a long and broad transverse process, which runs outwards and backwards, and widens out externally, joining the ilium immediately beneath the antitrochanter; the upper edges of these transverse processes are continued upwards into thin cribiform plates which unite above with the neural spine. The next transverse process is more slender but bears a similar plate, and, judging from the pelvis of *Æpyornis*, these plates were present in all the succeeding postsacrals, and are so arranged that they divide the posterior portion of the pelvis into a series of narrow chambers. In the present specimen all behind the seventeenth vertebra are broken away.

The dimensions of the pelvis are:—	cm.
Length of synsacrum as far as preserved.....	26
Approximate width between outer ends of the antitrochanters	13
Width between ventral edges of acetabula	7·5
Vertical diameter of acetabulum	4
Width in front of acetabulum	6

The Femur (Plate V. figs. 2 & 3).—The femur is rather more slender in proportion to its length than in *Æpyornis mulleri*, but otherwise is not strikingly different. The neck is very short and the head is shaped somewhat like the frustrum of a cone, the upper end of which is represented by the smooth surface which fits into the acetabular foramen. The trochanteric surface is continuous with that of the head, and the trochanter itself is less massive and projects less forwards than is the case in *Æpyornis*: its outer surface is deeply marked by the attachments of muscles (glutei, &c.). On the hinder face of the bone, immediately beneath the edge of the trochanteric surface, there is a large pneumatic foramen (*pn.f.*) partly closed by a cribriform plate of bone.

The shaft is slightly compressed owing to the flattening of the anterior and posterior surfaces, and this flattening is especially

marked towards the lower end, where the bone widens out towards the distal articulation. The popliteal fossa is deep, and there are several pneumatic foramina (*pn.f.*) opening into it; it is more strongly defined and extends further up the bone than in *Æpyornis*. The trochlear surface is rather flattened, and is separated from the intercondylar groove by a well-defined angle. The broad intercondylar groove is marked with two or three deep pits for the attachment of ligaments. The inner condyle is much as in *Æpyornis*, but in the outer the fibular surface is broader and the short ridge forming its supero-internal border is much more prominent.

Near the middle of the shaft and on its postero-external border there is a small nutritive foramen.

The Tibio-tarsus (Plate V. figs. 4 & 5).—The tibio-tarsus is relatively more slender than that of *Æpyornis mulleri*, and the antero-posterior compression of the shaft is a little less marked. The cnemial crests are well developed and rise high above the articular surface. Immediately beneath the rim of the hinder edge of the proximal articulation there is a deep concavity into which several foramina, probably pneumatic (*pn.f.*), open.

The distal portion of the shaft is greatly flattened from before backwards, and its anterior face is slightly concave from side to side. This concavity is deepest at the groove for the extensor tendons, which runs farther up the bone than in *Æpyornis* and is not quite so near the inner margin. The groove is bordered externally by a long and prominent ridge, and on the inner side by a short projection (fig. 5, *t*), which is evidently the partially ossified base of the otherwise tendinous bridge over the extensor tendons. The distal articulation is almost exactly like that of the tibia of *Æpyornis mulleri*. The so-called middle trochlea, a slight convexity between the outer and inner condyles, is very slightly developed. The post-condylar processes are sharply marked off from the condyles, and the outer at least projects more than in *Æpyornis*.

The Fibula (Plate V. fig. 6).—The fibula as far as preserved is 160 mm. long. Its upper end is large, and in correlation with the large size of the fibular surface of the femur it bears a large articular surface which extends a considerable distance down the outer side of the shaft. The surface for articulation with the fibular prominence of the tibia is oval and deeply concave. About a third of the length of the bone from its distal end there is a prominent tubercle for the insertion of the *biceps cruris*.

The Tarso-metatarsus (Plate V. figs. 7 & 8).—The tarso-metatarsus is a comparatively slender bone, and in general structure corresponds entirely with that of one of the smaller species of *Æpyornis*, e. g. *Æ. hildebrandti* as described by Burckhardt. In the proximal articulation the surface for the inner condyle of the tibia is much the larger, and is much wider antero-posteriorly than that for the outer condyle; there is no intercondylar process, but, on the other hand, there is a slight median concavity for the

reception of the so-called middle trochlea of the tibia. The upper part of the anterior face of the shaft is deeply concave owing to the posterior position of the upper end of the middle metatarsal; this concavity runs about three-quarters of the way down the shaft, and even below this the anterior face is slightly grooved for the adductor tendons. The inter-osseous foramina open at the same level anteriorly, and immediately beneath them is the single large tuberosity for the insertion of the tendon of the *tibialis anticus*. On the posterior surface of the bone, the upper end of the third metatarsal forms the bulk of the large talon, consisting of a prominent ridge on the outer side and a small tuberosity on the inner, separated by a shallow groove for the tendons. The main ridge of the talon is continued down the upper three-fourths of the trihedral shaft, of which it forms the posterior angle. In section, the middle portion of the shaft is triangular, the sides of the triangle being concave and the concavity of the anterior face being the deepest. A little above the distal articulation the shaft is convex in front and slightly concave behind. The middle trochlea is much the largest of the three and extends considerably beyond the inner one, which in size and form closely resembles the outer, much more nearly, indeed, than is the case in *Æpyornis*. Just above the notch between the outer and middle trochleæ, the bone is perforated by two foramina, one above the other but close together: of these the upper one (*add.*) pierces the bone and opens on the palmar aspect at the posterior end of the channel between the two trochleæ, the other opens in the middle of the same channel; the upper or posterior of these perforations probably transmitted the tendon of the *adductor digiti externi*, but the function of the other is unknown to me.

In a note on some remains of *Æpyornis* in the Tring Museum published some years ago*, I ventured to suggest that *Mullerornis rudis*, the metatarsal of which is said to be perforated by the tendon of the *adductor digiti externi*, should on that account be referred to a new genus, *Flacourtia*. If the presence of this character were really of generic value taken alone, the present species should likewise be referred to *Flacourtia*; but since the presence or absence of this perforation seems to be of very variable occurrence, it will be better to refer all the small, lightly built Æpyornithidæ at present known to one genus, *Mullerornis*, at least till some more valid distinctions are found, which may very well happen when the skulls and skeletons of the various species are known.

So far as can be seen, the thickening of the bones (pachyostosis), though of course much less in degree than in *Æpyornis*, is of precisely the same kind as that described by Burckhardt in the case of *Æpyornis hildebrandti*, and differs from the type found in the Dinornithidæ, in which the bones are much more solid and heavier.

* Novitates Zoologicæ, vol. ii. p. 25. Tring, 1895.

As already mentioned at the beginning of this paper, these specimens throw no light on the relationships and origin of the Æpyornithes, and it seems that in Madagascar we have a group of closely interrelated Ratites, varying enormously in size and in the degree of pachyostosis attained, but otherwise presenting few differences of importance, just as in New Zealand all degrees of size and massiveness exist between *Dinornis parvus* and *D. maximus* or *Pachyornis elephantopus*. In Madagascar, so far as known at present, the extremes are *Mullerornis agilis* and *Æpyornis titan*.

The dimensions of the limb-bones described are given below; those of the pelvis have already been noticed.

	cm.
Femur:	
Length	235
Width of the proximal end	8·4
Antero-posterior diameter of the shaft	2·9
Lateral diameter of the shaft	3·5
Width of the distal end	3·7
Tibia:	
Length to top of articulation	40·5
Length to top of cnemial crest	43·5
Width of the proximal end	6·2
Width of the middle of shaft	2·8
Width of distal end	6·2
Antero-posterior diameter of the shaft	2·0
Fibula:	
Length	upwards of 16·0
Antero-posterior width of proximal end	3·4
Lateral width of proximal end	1·6
Metatarsus:	
Length	27·3
Width of the proximal end	6·6
Width of shaft at narrowest	2·7
Width of the distal end	6·5
Width of the middle trochlea	2·5

Note on a new Ratite Bird (*Eremopezus eocænus*, gen. et sp. nov.) from the Upper Eocene of the Fayum District, Egypt.

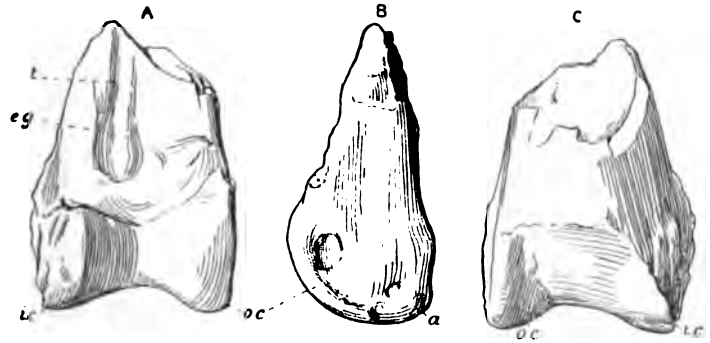
(Text-figure 15.)

One of the most interesting specimens collected from the Upper Eocene beds of the Fayum in 1902 is the distal end of the left tibio-tarsus of a large ratite bird. The fragment consists of the articulation and four or five centimetres of the shaft, and, except for a slight abrasion of the inner condyle, is in a sufficiently good state of preservation for it to be possible to observe all the important points in the structure of this highly characteristic portion of the skeleton. In fact, although of course much more

material is necessary before the precise affinities of this bird can be fully determined, probably from no similar fragment of any other bone of the skeleton could so much information be derived.

The outer condyle, the upper angle of which extends some distance up the antero-external border of the bone, seems to be larger in proportion to the inner than in the other Ratites except possibly *Struthio*. The condyles are very distinctly separated by a very well-marked intercondylar groove, in this respect more resembling the tibiæ of *Casuarius* and *Rhea*, and differing from those of *Æpyornis* and *Struthio*, in which the groove is very shallow. The post-condylar processes are not nearly so prominent as in *Struthio*, but about as in *Dromæus*; the outer post-condylar process does not extend nearly so far upwards as the condyle does anteriorly, and is sharply separated from it almost at a right angle (see text-fig. 15, B, *a*.) which forms the most distal point of the bone. The consequence of this arrangement is that the condylar articular surface looks more forward than is usually the case, though some approximation to this condition is seen in *Struthio*, and still more in *Rhea*. The surface between the post-condylar processes is slightly concave and passes gently into the posterior surface of the shaft, which, like the whole articular end of the bone, is strongly compressed from before backwards. The lateral faces of the condyles bear deep pits for the attachment of ligaments (text-fig. 15, B).

Text-fig. 15.



Distal end of left tibio-tarsus of *Eremopezus eocænus*.

A. From front. B. From side. C. From back.

a., angle between outer condyle and post-condylar surface; *e.g.*, extensor groove; *i.c.*, inner condyle; *o.c.*, outer condyle; *t.*, tubercle marking position of extensor bridge.

The figures are $\frac{2}{3}$ natural size.

The posterior face of the shaft passes by a gentle slope into the sharp antero-internal border of the bone, which is continuous with the upper angle of the inner condyle, as in *Casuarius* and *Dromæus*. The anterior face of the shaft near its inner border is deeply

channelled by the groove for the extensor tendons (text-fig. 15, A, *e.g.*); this groove is closed at its lower end by a strong ridge running upwards and outwards towards the outer border, and forming a prominent rugose surface above the outer condyle. There was no bony bridge over the tendons, but a slight ridge along the inner side of the groove marks the insertion of a strong tendinous sling (see text-fig. 15, A, *t.*).

Comparing this specimen with the tibio-tarsi of the other Ratites, it may be said that to some extent it combines the characters of several of them. In the depth of the extensor groove it approximates to *Rhea* and *Æpyornis*. The oblique ridge which blocks the lower end of the groove occurs also in *Struthio*, though in this case the groove itself is much shallower. In *Æpyornis*, on the other hand, the ridge is entirely absent and the groove runs nearly down to the condyles. The form of the outer condyle and its relations to the post-condylar process are similar to what is seen in *Rhea* and to some extent in *Struthio* also.

It seems clear that this bird differs widely from the other Ratites, and certainly from any of the Carinatæ, and I propose to name it *Eremopezus eocænus*.

The dimensions of the type specimen are:—

	cm.
Width of distal articular end	4·8
Width of lower end of shaft (at highest point preserved)	3·5
Width from front to back of the outer condyle	3·5

The occurrence in this region and in beds of Eocene age of a Ratite bird is a matter of considerable interest; but until sufficient remains are found to give a more definite idea of the relationships of this form, it will be unwise to draw any very wide conclusions. At the same time, it may be remarked that the existence of a true Ratite so long ago as the Eocene makes it at least possible that some of the main groups of the Ratitæ may have had a common ancestry, and are not the results of separate retrogressive modifications leading to the loss of flight, with the various correlated changes. In the present case the relationship between the Struthiones and the Æpyornithes, referred to by Burckhardt *, is naturally suggested; and the occurrence of Struthious birds (*Struthio* and *Hypselornis*) in the Pliocene of the Siwalik Hills may possibly indicate some remote connection between the present form and the *Dromæus-Casuarius* group. There is, however, another possibility that must not be lost sight of, and that is, that after all *Eremopezus* may be merely another instance of retrogressive modification leading to loss of flight and increase of bulk in a group of Carinate birds, such as has occurred in the case of the Stereornithes, the Gastornithes, and

* "Ueber *Æpyornis*," Palæont. Abhandlungen, N. F., vol. ii. p. 145 (Jena, 1893).

probably in most of the early so-called Ratite birds. These questions can only be settled by further excavations in the Libyan Desert and the discovery of more complete material.

EXPLANATION OF PLATE V.

Mullerornis betsilei M.-Edw. & Grand.

Fig. 1. Pelvis from side, p. 163.
2. Femur, posterior surface, p. 165.
3. „ anterior „
4. Tibio-tarsus, posterior surface, p. 166.
5. „ anterior „
6. Fibula, p. 166.
7. Tarso-metatarsus, posterior surface, p. 166.
8. „ anterior „

All the figures ½ natural size.

February 2, 1904.

H.G. THE DUKE OF BEDFORD, K.G., President, in the Chair.

Mr. R. Lydekker exhibited and made remarks upon a head of the Alaskan Moose (*Alces gigas* of American naturalists) which had been obtained by Lord Elphinstone in Alaska, and mounted by Mr. Rowland Ward.

Mr. J. E. S. Moore, F.Z.S., exhibited a series of lantern-slides illustrating the histology of cancer in animal tissues.

The following papers were read:—

1. On a Collection of Mammals from British Namaqualand, presented to the National Museum by Mr. C. D. Rudd. By OLDFIELD THOMAS, F.R.S., and HAROLD SCHWANN, F.Z.S.*

[Received December 15, 1903.]

(Plate VI.†)

By the generous help of Mr. C. D. Rudd, Mr. C. H. B. Grant, who had previously collected at Deelfontein the fine series of Mammals presented by Col. A. T. Sloggett, has been enabled to continue in the Cape Colony collecting material for the British Museum.

* Diagnoses of the new forms published in Abstracts P. Z. S. 1904, no. 2, pp. 5, 6 (Feb. 9th).

† For explanation of the Plate, see p. 183.

After a short stay in the Cape Peninsula, where he obtained useful topotypes of several long-known species, Mr. Grant went to Little Namaqualand in March 1903, and settled at Klipfontein, a place some 80 miles inland of Port Nolloth, at an altitude of about 1000 metres. He also stayed for shorter periods at Anenous, north of Klipfontein, 50 miles from the coast (alt. 600 m.), and at Port Nolloth itself.

So far as the British Museum is concerned, Namaqualand has been hitherto almost entirely neglected, the few specimens obtained there by Dr. Andrew Smith about 1830 (e. g. *Petromys typicus*, *Otomys brantsii*, &c.) and the little set collected by Dr. R. Broom at Port Nolloth in 1897 (including the type of *Otomys broomi*) being the only mammals that the Museum has ever received from that country. For the South African Museum Mr. Péringuey also collected a certain number at Klipfontein, as recorded by Mr. W. L. Sclater, but he does not seem to have come upon any of the new forms we now find it necessary to describe.

This is the first occasion in the history of Cape zoology that any considerable series of perfectly made modern skins have been compared, species by species, with another such series as that prepared by Mr. Grant at Deelfontein and the Cape; and we have thus been able to see what is the influence on the mammal fauna of the more northern and desert climate of Namaqualand. As might be expected, this shows itself in a general pallor, which is well exemplified in such forms as *Macroscelides melanotis*, *Cynictis penicillata pallidior*, *Otomys broomi* and *brantsii*, and *Arvicanthis pumilio cinereus*. On the other hand, the two animals which we have thought worthy to be distinguished as species instead of subspecies, *Herpestes ruddi* and *Bathyergus janetta*, are both darker, especially on the back, than their Cape representatives.

Of these two the Mongoose is a very distinct and handsome animal, easily separable from the Cape *Herpestes pulverulentus* by its blackened back and tail-tip. *Bathyergus janetta* again is of interest as being the second species of so peculiar and long-known a genus as *Bathyergus*, otherwise confined to the Cape.

In all, therefore, the Namaqua collection, which numbers about 160 well-prepared skins, is a most valuable accession to the Museum, and one for which we have every reason to be grateful to its donor, Mr. Rudd.

The following are Mr. Grant's notes* on the character of the country:—

"The appearance of the country as we proceed inland by rail, from the coast, strikes one as looking particularly dry and forbidding. Port Nolloth itself is on white sand which runs inland for perhaps ten miles, dotted here and there with milk- and Ty-bushes and a little grass in some of the water-courses. About the ninth or tenth mile on the railway the white sand gives place to

* Mr. Grant's notes on the character of the country and the habits of the animals were received too late for reading, but have been inserted since.—Feb. 20, 1904.

dry yellow or reddish-yellow sandy flats, stretching away on each side towards low or high mountain-ranges. Most of these have a yellowish appearance, the low stony rises or kopjes looking for all the world like huge heaps of gravel.

"Water is very scarce and is found in natural springs, either surface or by sinking; frequently the water-holes are considerable distances apart, and in the back country are almost impossible to find without a guide.

"The rainfall during my stay at Klipfontein was considered to have been the best for some years, being as follows:—

April.....	0·13 in.
May	1·41 ,,
June	0·96 ,,

A little fell in July and (at Port Nolloth during my short stay there) in August.

"Klipfontein, at an altitude of 3104 feet, is a wayside station on the railway between Port Nolloth and O'okiep, 54 miles by rail from the former place, situated on the top of the mountain-ranges which run between the Orange River and the Kamiesberg.

"The country is a series of mountains and small flats cut through with old water-courses, which either run down to the small flats on the top of the mountain-range or the lower flats running towards the coast. Often they form huge kloofs or cañons, some hundreds of feet in depth and 200 or 300 yards across, with enormous krantzes towering above and around the outer edges.

"The principal vegetation consists of several species of milk-bush and a small green bush some 2 or 3 feet in height, on which the wild buck and domestic stock feed; the several species of water- and rice-plants, a few scattered bushes and small trees on the kloofs and mountains, thorns in some of the river-beds, and the curious cookrerboom complete my rough list.

"Within a few miles of Klipfontein, on both the high and low ground, traps were set in every conceivable place, such as under bushes or rocks on the open flats, in the dry river-beds and kloofs. The most productive ground, however, was the dry river-beds, the rocky slopes and krantzes of the larger mountains, and the small stony kopjes on the flats."

1. Rhinolophus æthiops Peters.

♂. 436 *a*. ♀. 420. Klipfontein.

2. Nycteris capensis Smith.

♀. 459. Anenous.
♀. 429, 421. Klipfontein.

3. Miniopterus schreibersi Natt.

♂. 451. Klipfontein.

4. MACROSCELIDES RUPESTRIS Smith.

♂. 510, 453, 501, 425. ♀. 390, 468, 477. Klipfontein.

M. rupestris was first obtained by Smith from the "rocky mountains of Namaqualand," so that these specimens are practically topotypes.

The same author's *M. edwardi* is commonly considered to be a synonym of *M. rupestris*, but among Mr. Grant's collection from Deelfontein there is a series of a *Macroscelides* apparently distinct from the latter and probably referable to *edwardi*. This animal is darker and more greyish, its tail is less heavily pencilled, and its eyes have scarcely a trace of white rings.

"'Oliphant-muis' or 'Klas-nese' of the Dutch.

"Found only on the kopjes and in stony places. Remarkably quick when disturbed in getting from rock to rock and disappearing from view. It is curious to watch it dusting itself in some patch of loose sand among the rocks, its actions reminding one very much of a dog."—C. H. B. G.

5. MACROSCELIDES MELANOTIS Ogilb.

♂. 461, 393, 409. ♀. 423, 484, 433, 435, 531, 519. Klipfontein.

♀. 555. Port Nolloth.

This good series enables us to make for the first time a reliable comparison between *M. melanotis* and its ally *M. proboscideus*.

The former proves to be readily distinguishable by its much paler colour throughout and by its blacker and more heavily tufted tail.

"'Oliphant-muis' or 'Klas-nese' of the Dutch.

"Found only on the flats among the rocks and other cover. When disturbed it dodges round bushes and across open places at an amazing rate, with its tail in the air, frequently taking cover in the nest of *Otomys broomi*.

"Often observed in pairs."—C. H. B. G.

6. MYOSOREX VARIUS Smuts.

♂. 438. Port Nolloth.

Quite similar in colour to a series from the slopes of Table Mountain.

This specimen is abnormal in not having any trace of the minute premolars, the fourth unicuspids, usually present just anterior to the large p^4. in the upper jaw. Out of about a dozen examples from the Cape the same abnormality occurs on both sides in one skull, and on one side in another.

"'Skearer-muis' of the Dutch.

"One specimen was sent to me from Port Nolloth, but I could not find out exactly where it had been caught."—C. H. B. G.

7. FELIS CAFFRA Desm.

♂. 512, 456. ♀. 492, 509, 479, 463. Klipfontein.

"'Wilde-kat' of the Dutch.

"Not particularly common, frequenting the kloofs and clumps

of rocks on the open flats. Occasionally seen in the daytime, amongst the bushes on the flats, where they were sunning themselves when disturbed."—C. H. B. G.

8. GENETTA FELINA Thunb.

♂. 450, 534. ♀. 440. Klipfontein.

"'Misselyat-kat' of the Dutch.

"Not by any means common. Frequenting the deeper and rougher kloofs, where large rocks and the thickest bush prevails. Never seen during the day and trapped only at night. Apparently feeds principally on beetles and other insects."—C. H. B. G.

9. HERPESTES RUDDI Thos. (Plate VI. fig. 1.)

Herpestes ruddi, Thos. Ann. Mag. N. H. (7) xii. p. 465, (1903).

♂. 439, 508, 418, 507, 511, 406, 471, 474, 467, 527, 523. ♀. 411, 407, 448, 494, 526, 533. Klipfontein.

This handsome animal has already been described, and we now give a figure of it.

The discovery of so distinct a carnivore within the boundaries of Cape Colony is a striking example of the incompleteness of our present knowledge of mammals generally, and the value of such systematic surveys as that which Mr. Rudd has enabled Mr. Grant to carry on.

"'Commy-jee-baat muishond' of the Dutch. 'Tᶜeep'* of the Namaqualand Hottentots.

"Extremely common. Very difficult to avoid trapping them, as they are nearly always the first animals caught when traps are placed in a new spot. Frequenting kloofs, mountains, and the dry river-beds near clumps of rocks, in fact wherever there is sufficient cover. Sometimes seen in the daytime on the hunt in the big krantzes and larger kloofs. Food apparently consists of beetles &c., although I believe they destroy numbers of young dassies. Often taken in pairs."—C. H. B. G.

10. CYNICTIS PENICILLATA PALLIDIOR Thos. & Schw.

Cynictis penicillata pallidior Thos. & Schw. Abstr. P. Z. S. 1904, no. 2, p. 5 (Feb. 9th).

♂. 399, 415, 419. ♀. 404, 405. Klipfontein.

Similar to the typical *C. penicillata* but lighter throughout.

Central area of back "buff-yellow" of Ridgway compared with the "ochre-yellow" of the Cape form, the flanks rather lighter; under surface dull "cream-colour"; head like back, cheeks and neck much lighter than in *penicillata*, grizzled whitish. Back of ears in most specimens prominently dark brown, contrasting with the general colour of the head; a postauricular patch light yellow, not grizzled; fore limbs as in *penicillata*; under surface of hind limbs creamy white instead of "ochre-yellow," hind feet light creamy yellow. Tail about two-thirds as long as the head

* "Tᶜ" stands for a click.

and body, broad rather than round, very bushy, the breadth across the outstretched tail-hairs about 5 inches, its upper surface coloured like the back; the terminal two inches pure white; under surface creamy proximally, becoming gradually whiter distally. Individually the hairs of the under surface are cream-buff basally and white terminally, with a dark brown subterminal band. The tail of true *penicillata* is much darker, being "ochraceous" above, pencilled with black, and nowhere lighter than "ochraceous-buff" below, except at the tip, the light part of which barely exceeds an inch in length and is not so pure a white as in *pallidior*.

Dimensions of the type, measured in the flesh:—Head and body 328 mm.; tail 269; hind foot 76; ear 35.

Skull—basal length 64 mm.; greatest length 70·5 mm.

Type. Male. Original no. 399. Collected 7 April, 1903.

This subspecies differs from the typical *C. penicillata* in the general lighter colour of its upper surface and the much more conspicuous white tip to its tail.

None of the names currently placed as synonyms of *C. penicillata* appear to refer to the Namaqua *Cynictis*.

"'Rooi-meerkat' of the Dutch. 'Heryky' of the Namaqualand Hottentots. Habits similar to those of *Suricata suricatta*. Apparently not found in the low country near the coast."—C. H. B. G.

11. SURICATA SURICATTA Schr.

Viverra suricatta, Schr. Säug. iii. pl. 117 (1776) (*ex* Buff.).
Viverra tetradactyla, id. *t. c.* p. 434 (1777).

♂. 473, 536. ♀. 475, 528, 472. Klipfontein.

"'Meerkat' of the Dutch. 'Heryky' of the Namaqualand Hottentots.

"They make their burrows in the open veldt and under the clumps of rocks scattered about the flats. Although they are seldom found in great numbers, near Port Nolloth there are two or three colonies of considerable size.

"In this part of the country they seem very restless, constantly shifting their quarters.

"Exclusively diurnal. It is a pretty sight to see them sitting perfectly upright outside their holes, sunning themselves in the early morning.

"They apparently feed principally on beetles."—C. H. B. G.

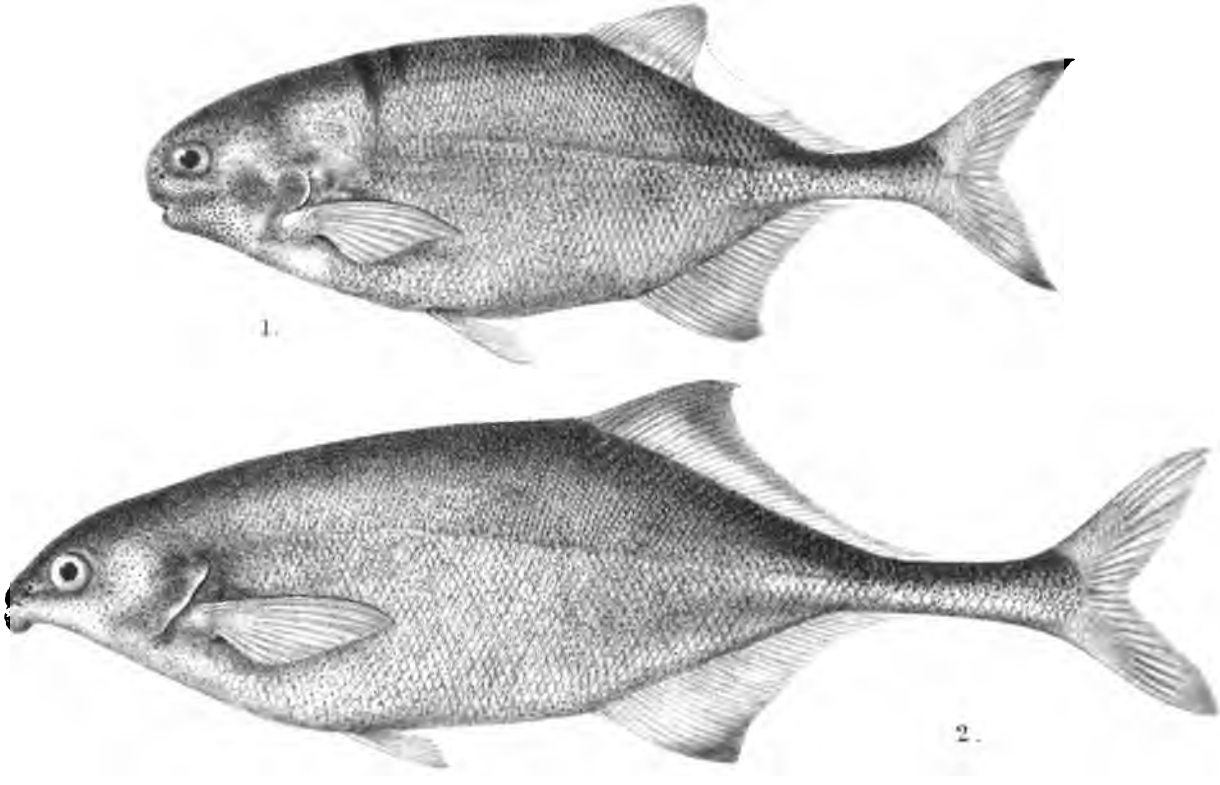
12. VULPES CHAMA Smith.

♂. 410, 416, 470. ♀. 424, 476, 396, 397. Klipfontein.

This pretty Fox has hitherto been almost unrepresented in the Museum Collection, so that the present series—practically topotypical—forms a very welcome accession.

"'Tᶜ* omma yackal' of the Dutch.

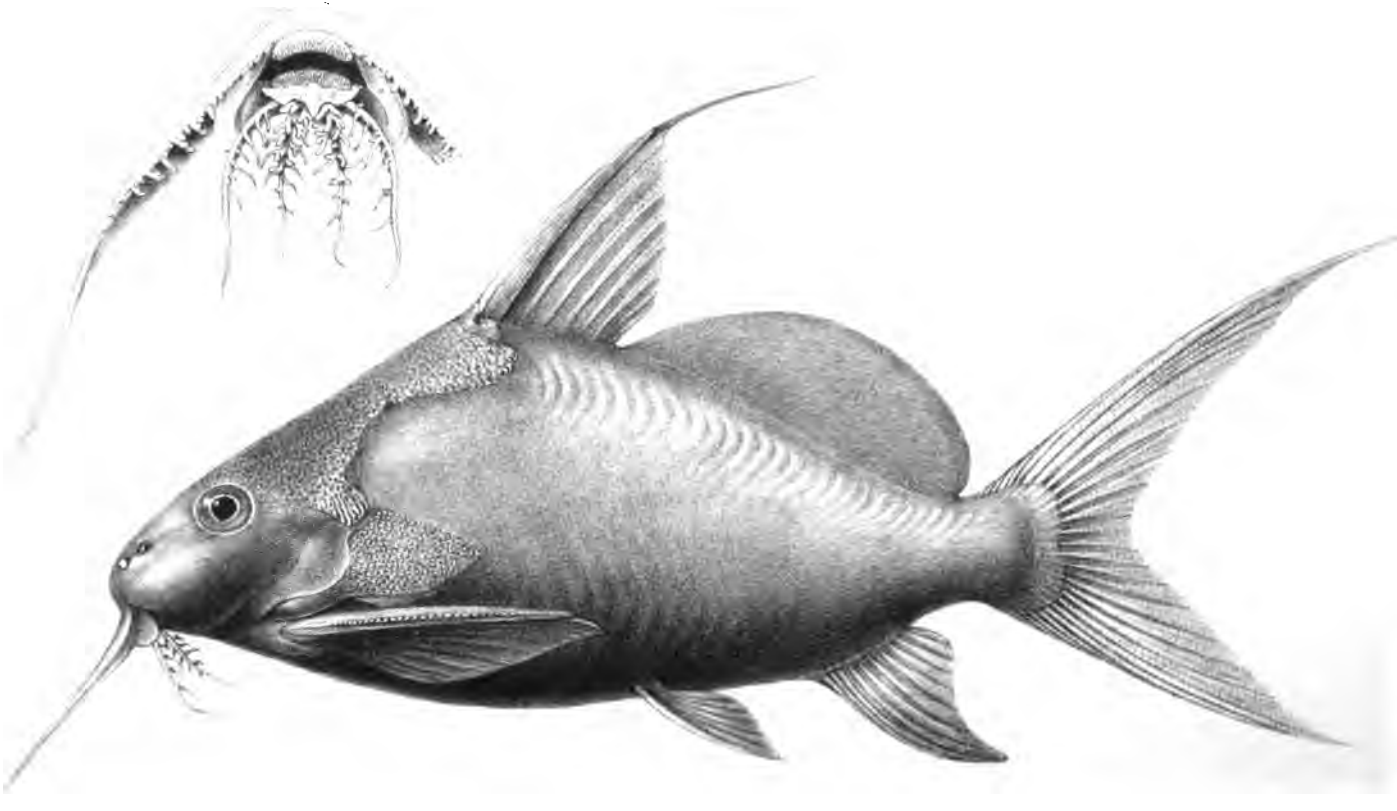
* Tᶜ stands for a click.



J.Green del et lith.

Mintern Bros. imp.

1. MARCUSENIUS BUDGETTI. 2. GNATHONEMUS GILLI.



J Green del et lith

Mintorn Bros imp

SYNODONTIS RESUPINATUS.

"Very common, frequenting the more open country and sleeping during the day in the dry river-beds and the stony kopjes on the flats. They are very wary, and when disturbed usually get up out of range.

"Trapped at night in their sleeping-places or near meerkats' burrows, where possibly they were on the look-out for a late straggler.

"Their food consists of beetles, &c."—C. H. B. G.

13. ICTONYX CAPENSIS Kaup.

♂. 490, 530. ♀. 497, 503. Klipfontein.

♂. 537, 538. Anenous.

"'Vit-rôq (white-backed) muishond' of the Dutch.

"Frequenting both the kloof and the open flats. This animal is very destructive to poultry, killing them for the sake of their blood only. Usually found in pairs and often caught one after the other in the same trap."—C. H. B. G.

14. MELLIVORA RATEL Sparrm.

♀. 464, 465. Klipfontein.

Indistinguishable from Cape specimens.

"'Ratel' of the Dutch.

"Not uncommon. The two specimens were secured in an old ant-bear hole on the sandy flats close to Anenous."—C. H. B. G.

15. GRAPHIURUS OCULARIS Smith.

♀. 417, 486. Klipfontein.

These specimens represent the *Graphiurus elegans* of Ogilby*, of which the type was collected by Capt. Alexander in Damaraland.

The tail is rather whiter than that of the Cape form, and the animals may perhaps hereafter prove subspecifically separable, in which case they would bear the name of *G. ocularis elegans*.

"'Gemsbok-muis' of the Dutch.

"Rare, possibly frequenting all rocky places, as in the Karoo. Exclusively nocturnal. Where these two specimens were caught, traps were kept set for some weeks, but yielded no further results."—C. H. B. G.

16. DESMODILLUS AURICULARIS Smith.

Gerbillus auricularis Smith, S. Afr. Quart. Journ. ii. p. 160 (1834).

Desmodillus (g. n.) *auricularis* Thomas & Schwann, Abstr. P. Z. S. 1904, no. 2, p. 6 (Feb. 9th).

♀. 458. Anenous.

A topotype of the species, which was described by Smith from a specimen captured by him in "the mountains of Little Namaqualand."

This Gerbille has been variously regarded as a true *Gerbillus*

* P. Z. S. 1838, p. 5.

and as a *Pachyuromys*, but after careful consideration we think that it needs a special generic name. From *Gerbillus* it differs, among other characters, by its shorter tail and very much larger bullæ, in which respects it approaches *Pachyuromys*. But its thin, unswollen tail, its narrow faintly-grooved incisors, normally shaped palatine foramina, less exaggerated bullæ, and widely different geographical distribution prevent its being referred to the latter genus, towards which, however, it may be regarded as forming a link (*δεσμός*).

Mr. Grant also obtained an example of this species when collecting for Col. Sloggett at Deelfontein.

"This animal was reported as being very common, especially in some of the old stone blockhouses along the line."—C. B. H. G.

17. Otomys broomi Thos.

Ann. Mag. N. H. (7) x. p. 313 (1902).

♂. 466, 434, 462. ♀. 437, 432, 460, 524. Klipfontein.

This species, the Namaqualand representative of *O. unisulcatus*, was discovered by Dr. Broom at Port Nolloth in 1897. The Klipfontein series quite agrees with his two specimens as far as regards colour and the great size of the ears, but the bullæ are perhaps less definably larger.

"'Veldt-rot' of the Dutch.

"Frequenting the open flats and the lowest slopes of the mountains and kopjes, where it makes a nest of sticks about 2 feet high in the bottom of a milk-bush, with a hole close beneath the surface. Above ground regular runs connect one nest with another.

"Apparently not more than one pair inhabits each nest, and when disturbed from it will run along their well-worn tracks to another close at hand.

"A vegetarian."—C. B. H. G.

18. Otomys brantsii Smith.

♂. 446, 441. ♀. 400, 395, 403, 394, 455, 442. Klipfontein.
♂. 388. Port Nolloth.
♀. 389. Anenous.

The original *Euryotis brantsii* of Smith was described from two specimens, male and female. The former was "tinted strongly with fulvous" and "pencilled freely with black"; the latter, which the National Museum still possesses, is distinctly paler, and agrees very well in colour with the above series from Klipfontein. As this locality is very near the one quoted by Dr. Smith, "toward the mouth of the Orange River," it would be advisable to accept the female as the type and to ignore the darker male, which may have come from quite another region. The Namaqua series might therefore be treated as topotypes.

Compared with these the set collected at Deelfontein are sufficiently different to require subspecific distinction.

The new form may be called *Otomys brantsii luteolus*, and may

be distinguished by the brownish fulvous of its dorsal area, which approaches Ridgway's "russet," in strong contrast with the paler, almost "cream-buff" of *O. brantsii*. The back is also of a more uniform colour, less markedly lightening on the sides. Under surface like that of the typical form. Tips of the hairs on the head, back, and sides black. Tail strong buffy yellow, darker than in *brantsii*, a line along the top and the whole of the tip black.

Dimensions of the type, measured in the flesh:—Head and body 145 mm.; tail 76; hind foot 25; ear 16.

Skull—greatest length 34·7 mm.; basilar length 27·5; greatest breadth 21.

Hab. Deelfontein, Central Cape Colony.

Type. Female. B.M. no. 2.9.1.47. Collected 8 April 1902. Presented by Col. A. T. Sloggett.

The grooving of the incisors in *O. brantsii* seems always to have been considered the same as in *O. unisulcatus*, *i. e.* with one groove on the outer part of the upper incisors and none on the lower. But we find a distinct groove on the inner edge of the upper pair in addition to the larger groove on the outer half. There is also an indistinct flattening, hardly amounting to a groove, on the outer half of the lower incisors.

"'Sand-rot' of the Dutch.

"Very common; found all over the high and low flats, but not observed within ten miles of the coast. They are gregarious, living in colonies and digging their burrows in the open sandy veldt. A diurnal animal only and a vegetarian. Numbers of them are to be seen sitting on their haunches outside their holes. On the appearance of danger they disappear at once, each with a sharp squeak."—C. H. B. G.

19. Mus auricomis de Wint.

♂. 428, 401, 430, 497, 445, 457. ♀. 504, 422, 498, 489, 496, 454, 447, 415. Klipfontein.

Very similar to the original series collected by Mr. Selous in Matabeleland.

"Entirely a rock rat, very common everywhere on the flats and mountains where there are rocks. Apparently entirely nocturnal and vegetarian."—C. H. B. G.

20. Arvicanthis pumilio cinereus Thos. & Schw.

Arvicanthis pumilio cinereus Thos. & Schw. Abstr. P. Z. S. 1904, no. 2, p. 5 (Feb. 9th).

♂. 427, 493, 391, 431, 488, 426, 436. ♀. 499, 514. Klipfontein.

♂. 540. Port Nolloth.

General colour of the face and upper surface, in the majority of specimens, "smoke-grey," compared with the buffy-yellow of the true *pumilio*. Long hairs tipped with orange-yellow or black, dirty white proximally; under-fur black at base. Flanks

decidedly greyer than in *A. pumilio*; ears bright tawny as in the typical form, but more strongly contrasted owing to the greyer colour of the head and neck.

Dimensions of the type, measured in the flesh:—Head and body 118 mm.; tail 128; hind foot 28; ear 18.

Skull—basilar length 24 mm.; length of upper tooth-series 5.

Hab. Klipfontein.

Type. Female. Original no. 514. Collected 16 June, 1903.

This Namaqua representative of the common *A. pumilio* may be distinguished from its Cape ally by its paler, greyer colour, and especially by its much greyer flanks.

"'Streep-muis' of the Dutch.

"Inhabiting the heaps of stones along the railway and the stone walls of the native gardens.

"Common and exclusively diurnal. It may frequently be seen sunning itself on some flat rock or sandy patch in the heat of the day. Its food, so far as I have seen, is entirely vegetable."—C. H. B. G.

21. BATHYERGUS JANETTA Thos. & Schw. (Plate VI. fig. 2.)

Bathyergus janetta Thos. & Schw. Abstr. P. Z. S. 1904, no. 2, p. 6 (Feb. 9th).

♂. 551, 541, 562, 544. ♀. 546, 548, 545, 552, 554, 564, 553. Port Nolloth.

Much smaller than *B. maritimus*, the back with a dark median band.

General ground-colour not materially different from that of the Cape species, *i. e.* "drab-grey"; but the whole dorsal area, for a breadth of about 2 inches, is seal-brown, contrasting markedly with the drab-grey of the shoulders and sides. Under surface blackish-slaty, rather darker than in *B. maritimus*; chin with a white sharply-defined patch. Head wholly blackish, except that there is sometimes a narrow white line along the top of the nose. Area round ear white, bright colour of flanks commencing just behind ear. Proximal part of limbs dark slaty; hands and feet white. Tail broad, flattened, its central part pale brown, its fringing hairs dull whitish.

Skull conspicuously smaller than in *B. maritimus*, its shape, in fully adult examples, more like that of young specimens of the Cape species. Brain-case smooth and rounded, the ridges and crests at a minimum. Interorbital region broad, smoothly rounded. Proportions of nasals as in *B. maritimus*. Palate less produced backwards. Bullæ rather more swollen.

Incisors deeply and simply grooved as in *B. maritimus*, their breadth about as in half-grown specimens of that species.

Dimensions of the type, measured in the flesh:—Head and body 181 mm.; tail 43; hind foot (s.u.) 34.

Skull—greatest length 46·5 mm.; basilar length 40·5; greatest breadth 28·7; nasals 3·6 × 15·4; interorbital breadth 9·5; least breadth behind zygomata 18·8; greatest mastoid breadth 24; diastema 14·4; palate length 14·5; greatest diameter of bullæ

13·8; length of upper tooth-series (crowns) 8·4; combined breadth of upper incisors 5.

Type. Female. Original no. 545. Collected 3 August, 1903.

This handsome and distinct Mole-Rat is widely different from the only hitherto known species of the genus. A reference to the occurrence of *Bathyergus* in Namaqualand is given by W. L. Sclater*, but he tells us that he had not seen examples from there, and his informant had no doubt mistaken *B. janetta* for *B. maritimus*.

In this species there is a marked difference in size and in the development of the cranial ridges between the skulls of males and females, much more so, indeed, than appears to be the case in *B. maritimus*. An old male skull of *B. janetta* measures 48·5 mm. in basilar length, with a zygomatic breadth of 36 mm.

"'Mollee' of the Dutch.

"Common on the white sands near Port Nolloth, where it makes regular runs and mounds.

"It is a great nuisance to the platelayer on that section of the line, undermining the sleepers and often causing a dangerous drop in the metals when a train passes."—C. H. B. G.

22. PETROMYS TYPICUS Smith.

♂. 444, 517, 522, 518. ♀. 487, 480, 500, 443, 513, 529, 469. Klipfontein.

The Museum now obtains for the first time a good series of this uncommon animal, which was described by Smith in 1831 from specimens collected by him "upon the rocky hills which occur towards the mouth of the Orange River." Dr. Broom also obtained some examples at Port Nolloth.

The dimensions of an adult male, measured in the flesh, are as follows:—Head and body 160 mm.; tail 160; hind foot 34; ear 15.

"'Klip-muis' of the Dutch. Noki† of the Namaqualand Hottentots.

"Very common, frequenting the rocks on the kopjes and mountains and the slides of loose stones thrown out of the railway-cuttings. Each one seems to have his own hole, and can be seen day after day lying in the sun on some favourite spot in front of it. Often in the early morning several are to be seen up a bush, feeding on the leaves."—C. H. B. G.

23. LEPUS SAXATILIS Cuvier.

♂. 452, 520. ♀. 525. Klipfontein.

"'Rhebok-haas' of the Dutch.

"Frequenting the open flats on the top of the mountain-range, the lower slopes of the kopjes, and the dry river-beds.

"Common, but exceedingly difficult to find without a dog.

"Feeds only in the early morning and late evening."—C. H. B. G.

* Mamm. S. Afr. ii. p. 73 (1901).

† The "N" of Noki is sounded as a click.

24. LEPUS CAPENSIS GRANTI Thos. & Schw.

Lepus capensis granti Thos. & Schw. Abstr. P. Z. S. 1904, no. 2, p. 6 (Feb. 9th).

♂. 506, 505, 557, 561, 558, 566, 547. ♀. 543, 550, 560, 542, 559, 565, 563, 556. Port Nolloth.

♂. 535. Anenous.

General colour above of the head and back "broccoli-brown," with a very faint mauve suffusion. Individually the long hairs are black, becoming lighter terminally; the under-fur "=french-grey" at the base, "drab-grey" distally. Sides of the head, shoulders, and flanks "ecru-drab." A few scattered hairs about 1½ in. long bordering the flanks, black proximally, white terminally. Head like back, margin of nostrils and upper lip and a ring round eyes white. Ears distinctly larger than in the true *capensis*, fringed with white hairs, the tips dark brownish black. Nape and base of ears "ecru-drab." Under surface, with the exception of a white patch along the centre of the belly, deep "vinaceous buff." Inner side of thighs and hind feet pinkish buff. Tail as in *capensis*, black above, pure white below.

Dimensions of the type, measured in the flesh:—Head and body 454 mm.; tail 106; hind foot 115; ear 126.

Skull—greatest length 88 mm.; basilar length 67·5.

Hab. of type. Port Nolloth.

Type. Male. Original no. 561. Collected 12 August, 1903.

The common Namaqua Hare proves to be very similar below to the Deelfontein form, while its general colour above is very much that of the true *capensis*.

The four members of the present group may be distinguished as follows:—

A. Nape grey or vinaceous.
  a^2. Back greyer; ear-fringes whitish.
    a^3. Nape grey ..... *L. capensis.*
    b^3. Nape vinaceous ..... *L. c. granti.*
  b^2. Back and ear-fringes dull buffy ..... *L. c. centralis.*
B. Nape yellow ..... *L. ochropus.*

"'Vlackte-haas' of the Dutch.

"Very common on the white and red sand-veldt near Port Nolloth, less so on the lower flats (1774 ft.) near Anenous, while only one was seen on the flats on the mountain-range."—C. H. B. G.

25. ORYCTOLAGUS CRASSICAUDATUS MELANURUS Rüpp.

Lepus melanurus Rüpp. Mus. Senck. iii. p. 137 (1845).

♂. 515, 516, 521, 539, 539 *a*. ♀. 483, 491, 478, 485. Klipfontein.

This handsome black-tailed Rabbit, which is quite new to the Museum collection, agrees well with the description of Rüppell's *Lepus melanurus*, and may be safely identified with it. Our only doubt is whether Smith's *rupestris*, dating from 1834, is not also the same form, a point which can only be settled when series of young specimens are available for examination.

"'Klip-haas' of the Dutch.

"Frequents the kopjes and mountains, and is nearly always seen among the thickest bushes and bigger rocks. The specimens were mostly secured in the early morning while out feeding on the more open places. The speed with which this animal can get over the rocks and boulders must be seen to be believed."—C. H. B. G.

26. PROCAVIA CAPENSIS Pallas.

♀. 449. Klipfontein.

"'Dassie' of the Dutch.

"Although many signs of this animal were seen on the krantzes, very few of them were actually observed and seldom in the same place twice. This may possibly be owing to the previous dry season, which kept them constantly on the move to find food, consequently they were very much scattered and extremely wild."—C. H. B. G.

27. RAPHICERUS CAMPESTRIS Thunb.

♀. 502. Klipfontein.
♀. 549. Port Nolloth.

28. OREOTRAGUS OREOTRAGUS Zimm.

♂. 495. Klipfontein.

EXPLANATION OF PLATE VI.

Fig. 1. *Herpestes ruddi*, p. 175.
2. *Bathyergus janetta*, p. 180.

2. On the Arteries of the Base of the Brain in certain Mammals. By FRANK E. BEDDARD, F.R.S., Prosector to the Society.

[Received January 12, 1904.]

(Text-figures 16–22.)

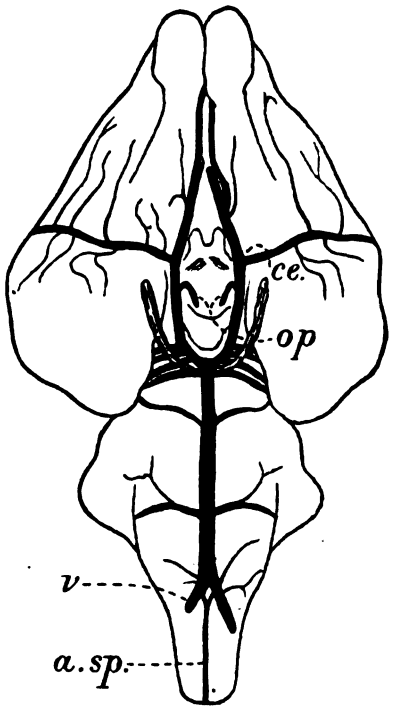
There has recently been published a comprehensive memoir upon this subject by Dr. Tandler*, in which previous observations, referring for the most part to single types, are included. Before becoming acquainted with this memoir, I had caused a number of injections of the brain of various mammals to be made, with the view of investigating the subject. I find on examination of my material and notes that I have something to add to the facts and conclusions made known in the memoir of Dr. Tandler; for I have had the opportunity of studying some genera which that anatomist had not at his disposal, and certain parts of the arterial system to which it was not his object to pay special attention.

* "Zur vergleichenden Anatomie der Kopfarterien bei den Mammalia," Denkschr. Akad. Wiss. Wien, Bd. 67, 1899, p. 677.

§ *Circle of Willis and Basilar Artery.*

Chinchilla lanigera.—Of this Rodent I have examined two brains. One is so perfectly injected that it appears to me to be worth figuring (text-fig. 16) and describing in detail, as a contribution to the knowledge of the cerebral circulatory system in mammals. Commencing at the posterior end, the two vertebral arteries unite to form the basilar artery. Close to their junction two arteries on the left and three on the right are given off, which appear to be collectively the equivalents of the inferior cerebellar arteries of Man.

Text-fig. 16.



Base of brain of *Chinchilla lanigera*.

a.sp., anterior spinal artery; *ce.*, junction of middle and anterior cerebral arteries; *op.*, ophthalmic arteries; *v.*, vertebral arteries.

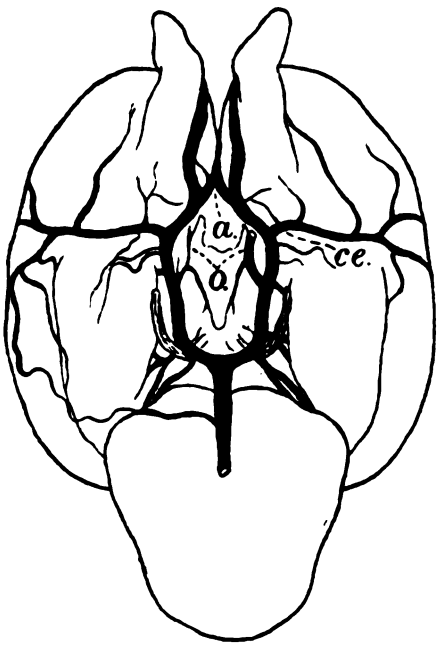
They are, however, mainly arteries for the supply of the medulla and adjacent parts, and if they reach the cerebellum at all it is only their most feeble twigs that do so. Close up to the junction of the vertebrals rises by a root from each the minute and backwardly running anterior spinal artery. Further up the basilar artery, but well behind the origin of the sixth nerves, arises

symmetrically on either side a middle cerebellar artery. Each artery has two main branches. Here again the blood-supply to the cerebellum from this artery must be very small. In the second and less perfectly injected brain a small branch on either side arises behind the middle cerebellar, which may be one of the branches of the posterior cerebellar advanced rather forward. Between the middle cerebellar and the bifurcation of the basilar artery to form the circle of Willis are three or four transverse arteries, of which one pair are particularly well marked in both specimens. Immediately after the bifurcation of the basilar artery arise the anterior cerebellar arteries, which are stout arteries and of as great calibre as any given off from the circle of Willis. They constitute the main if not the only blood-supply of the cerebellum. The third nerve separates this artery from the posterior choroidal, which is of less calibre. Between this artery and the posterior cerebral arises an artery of about the same dimensions which is an adjunct of the latter, and on the right side of one specimen arises in common with it from the circle of Willis. The posterior cerebral artery is of the same calibre as the other cerebrals and the anterior cerebellar. The circle of Willis is long and narrow, relatively speaking. About halfway between the posterior and middle cerebral arteries, exactly on a level with the pituitary body, the very slender ophthalmic arteries join the circle. The dimensions of these arteries are not greater than those of some of the more inconspicuous branches of the basilar artery; but as both specimens were identical in this particular, I take it that the state of affairs is normal. Just before the origin of the middle cerebral arteries arises a small artery on either side supplying the temporal lobes of the cerebrum. As this vessel occurred in both brains, I take it to be of some little importance. The middle cerebral artery supplies, as will be seen from the drawing (text-fig. 16, p. 184), the greater part of the cerebral hemispheres. The anterior cerebral arteries are unconnected by any anterior communicating artery, but apparently pass into one in the region of the corpus callosum, thus completing the circle.

In the allied *Lagostomus trichodactylus* the characters of the brain arteries appear to me to be the same in all essentials. The ophthalmics and the anterior spinal artery are minute. This brain, however, enables me to ascertain one point which is very possibly the same in *Chinchilla*, but which I was not able to elucidate in that rodent. In *Lagostomus* the anterior cerebral artery of the left side divides at once into two large and equisized branches, of which the outer supplies the under surface of the anterior lobe of the brain, whilst the other plunges into the inter-hemispheral sulcus, and is the main anterior cerebral trunk. It soon divides above the corpus callosum into two branches. In *Chinchilla* it is also apparently the left branch only which supplies the (in this case single and median) anterior cerebral artery; but a break in the right branch supplying the under surface of the hemispheres does not allow me to speak with absolute certainty.

In *Myopotamus coypu* I detected some characteristics of the arteries not observable in the other rodents studied by me. The carotids * appear to be absent and the ophthalmic arteries descend (or rather, of course, ascend) to the circle of Willis in close contact with, and bound by connective tissue to, the optic nerve. That of the left side is, as is shown in the accompanying drawing (text-fig. 17), much larger than that of the right side. Before reaching the circle of Willis each artery gives off a strong branch to the pituitary body, from which arise several small arteries running forward to and over the tuber cinereum to the optic

Text-fig. 17.



Base of brain of *Myopotamus coypu*.

a., callosal artery; *ce.*, junction of anterior and middle cerebrals; *o.*, ophthalmic arteries.

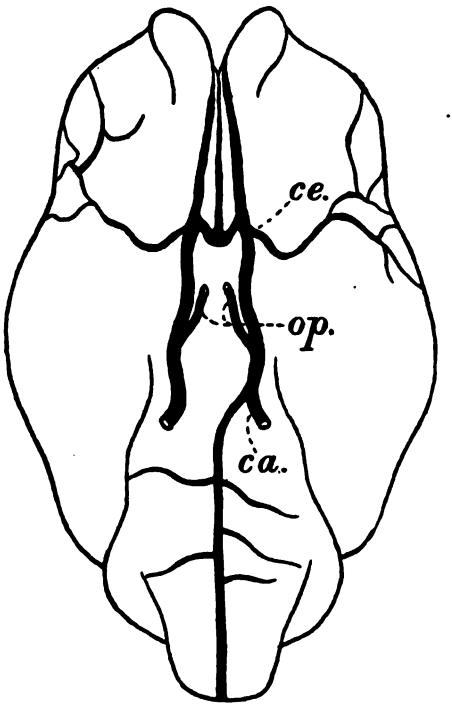
chiasma. The anterior cerebellar artery divides very soon on the left side, and a little later on the right, into two equisized branches. In front of this the posterior choroidal and the posterior cerebral arise by a common stem. Nearly opposite to, but a little in front of, the entrance of the carotid into the circle of Willis arises a stout artery (quite as large as the posterior cerebral) which immediately plunges beneath the pyriform lobe. I suppose that this

* The same state of affairs exists, according to Tandler, in *Cavia cobaya*.

is possibly the equivalent of the anterior choroid artery of Man. I did not find it in the other rodents. I, however, found in *Myopotamus* an artery supplying the surface of the pyriform lobe, such as exists in *Chinchilla* and *Lagostomus*, and rising just behind the middle cerebral. The anterior cerebral is more symmetrical than in those Rodents. Each divides into two equal branches not far from its origin: of these the outer runs along the olfactory region of the lower surface of the hemispheres; the inner joins the corresponding branch of the opposite side, becomes the single callosal artery, and before it reaches the surface of the corpus callosum again divides into two.

Hyrax capensis.—The arteries at the base of the brain of *Hyrax* show certain differences from those of other mammals referred to

Text-fig. 18.



Base of brain of *Hyrax capensis*.

ca., carotid artery; *ce.*, junction of middle and anterior cerebrals; *op.*, ophthalmic arteries.

in the present communication. A noteworthy point is the great length of the basilar artery, the point of formation of which from

the conjoined vertebrals I was unable to see*. It is evidently therefore longer than in some other forms. Another peculiarity is that all three cerebellar arteries—not merely the two posterior—arise from the undivided basilar artery. A still more remarkable peculiarity, again, is shown in a complete absence on the right side of any connection between the basilar artery and the posterior cerebral. The circle of Willis is thus incomplete posteriorly. On the other side of the body the basilar artery, after passing straight forwards under the pituitary body, bends sideways and is connected with the left posterior cerebral artery. The anterior communicating artery is, however, present on both sides, as is shown in the drawing (text-fig. 18, p. 187), and connects the anterior and middle cerebral arteries. Quite posteriorly, in fact behind the third nerve, the communicating arteries end in the carotid. These arteries are large, and it is interesting to note that their position, at the posterior end of the circle of Willis, is precisely the same as it is in the Horse; and that so far, therefore, *Hyrax* is nearer to the Perissodactyle† than to the Artiodactyle section of the Ungulates, in which latter the carotid does not, as a rule, reach the circle of Willis at all.

The ophthalmic arteries are of less calibre than the posterior communicating arteries, which they join well behind the circle of Willis. They are, however, by no means rudimentary in character. Before giving off the middle cerebral, the anterior communicating artery of each side gives off a well-developed branch to the hemispheres, upon the presence of which I have commented in *Chinchilla* and other mammals. The anterior communicating artery is formed by a longish commissure uniting the two very strong olfactory arteries, from the middle of which commissure arises the slender and at first single anterior cerebral artery.

Tamandua tetradactyla.—Hyrtl and Tandler‡ have dealt with some of the cerebral arteries of this Edentate. But my own results derived from the study of a well-injected brain supplements those of the two anatomists mentioned.

The condition of the basilar artery appears to me to explain the apparently abnormal length of the same in *Hyrax*. At first sight there appears to be an exact correspondence. A closer examination, however, shows that, at a distance of 17 mm. behind the circle of Willis, the basilar artery divides into two branches, which almost immediately reunite, enclosing a brief rhomboidal space, as is clearly shown in the drawing (text-fig. 19, p. 189). What has happened is evidently an exaggeration of the median anterior spinal artery, and a reduction of the interval lying between the anterior bifurcation of this artery and the posterior bifurcation of the basilar artery. *Hyrax*, as it appears to me, is

* I may observe that the brains which are described here consist of the brain itself and of the cord down to the atlas. Before the brains are extracted the cord is cut as near to the atlas as possible.

† Chauveau, 'Traité d'Anatomie Comparée des Animaux Domestiques,' 2nd ed. by Arloing (Paris, 1871), p. 618, fig. 241.

‡ Who summarises previous observations.

the extreme term in this same series. As I shall point out, some other Ungulates agree.

In some of the Carnivora which I have had the opportunity of examining there is, it must be admitted, a tendency in the same direction. But in them the gap between the basilar and the anterior spinal is never quite so inconspicuous as in *Tamandua*,

Text-fig. 19.

Base of brain of *Tamandua tetradactyla*. The small figure on the right shows the plexus referred to in the text.

b., rhomboidal space enclosed by spinal artery; *c*., carotids; *ce*., junction of middle and anterior cerebrals; *o*., ophthalmic artery; *v*., vertebral artery.

while, moreover, the vertebral arteries are much more conspicuous. *Tamandua* is a little more Ungulate-like than Carnivore-like in both of these points. At the same time it must be observed that the vertebral arteries are larger proportionately than they are represented by Tandler to be in *Bos taurus*, but certainly not so

large as I find* them to be in the following Carnivora:—*Felis tigris*, *F. leo*, *Viverra civetta*, *Ursus syriacus*, *Arctictis binturong*, *Canis occidentalis*, *Galictis barbara*, *Genetta pardina*, *Suricata tetradactyla*, and *Herpestes auropunctatus*. In view of conflicting opinion as to the affinities of Edentates we cannot, I think, afford to neglect even the smallest indications.

I may further point out that in the Carnivora generally, so far as my experience allows me to state, the vertebral arteries enter at the middle of the rhomboid formed by their union with the anterior spinal. It is not the case, however, with *Galictis*, which in this feature comes nearer to *Tamandua* than does any other carnivore.

Immediately after the division of the basilar artery anteriorly to form the circle of Willis, and behind the third nerves, two arteries are given off on each side, and on the right side a third which is represented by a small twig only on the left. They all arise at appreciable distances from each other. The number is obviously unusual; but, so far as I can ascertain, all these arteries are cerebellar. In front of the third nerve arises the posterior cerebral. Owing to the considerable antero-posterior length of the circle of Willis, this artery is very greatly in advance of the bifurcation of the basilar artery, and yet well behind the level of the entrance of the carotids into the circle.

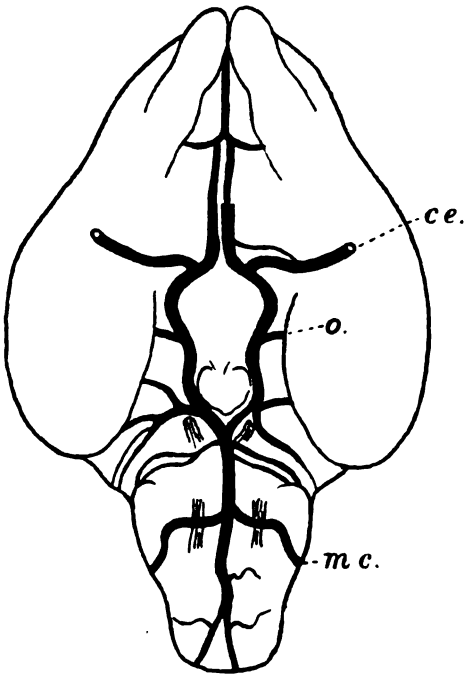
That portion of the brain-surface which lies within the circle of Willis, behind the origin of the posterior cerebral arteries, is covered with a plexus of blood-vessels derived from the anterior side of the posterior arterial trunk which forms the circle of Willis. I have observed a similar plexus in a Gazelle (*Gazella rufifrons*), but hardly venture to bring this fact forward as evidence of Ungulate affinity in the brain of *Tamandua*. The carotids are more slender than the circle of Willis into which they debouch. About halfway between this point, which, as will be seen from the drawing (text-fig. 19, p. 189), is about on a level with the infundibulum, and the optic nerves is given off on either side the middle cerebral artery. The circle of Willis is completed anteriorly in a way often found among mammals, the junction being effected before the single artery derived therefrom is lost to sight in the interhemispheral sulcus.

The cerebral arterial system of *Tragulus meminna* presents certain peculiarities of its own (text-fig. 20, p. 191). Concerning the basilar artery and its lateral branches, there are at least two important facts to be noticed. In the first place, the middle cerebellar artery, so unimportant as a source of cerebellar blood-supply in such Rodents as I have studied, is fully equal in size to the anterior cerebellar artery, and can be easily traced into its ramifications over the posterior half of the cerebellum. It gives off on the way important branches to the roots of the fifth and seventh and eighth nerves. The second and striking fact about

* *Loc. cit.* p. 775, woodcut, fig. III.

this artery is that *it arises in front of the sixth nerve as in Man*, and not behind it as in at least many other mammals. The anterior cerebellar artery has also a somewhat anomalous position and character. It arises from the basilar artery before—but only just before—the latter divides to form the circle of Willis. On the right side the anterior cerebellar artery divides soon into two equisized branches. On the left side there are also two branches, but they arise separately from the basilar artery. Another remarkable fact is that a strong branch arises on the left side from the middle cerebral and joins the anterior cerebral after a nearly straight course. This branch lies to the outside of the third nerve. On the right side is a corresponding, but more slender and perhaps even slightly imperfect anastomosis.

Text-fig. 20.



Base of brain of *Tragulus meminna*.

ce., middle cerebral artery; *mc.*, middle cerebellar artery; *o.*, ophthalmic artery.

The posterior cerebral artery divides, as in other mammals, and at once, into two main branches. The anterior (which on the left side of the brain arises separately from the circle of Willis) immediately buries itself below the lobus pyriformis. The posterior branch divides again into several others, which run at

first between the cerebrum and the cerebellum. It is remarkable that from the most posteriorly situated of these branches a considerable twig goes to the cerebellum.

The circle of Willis has an hourglass-shaped outline like that in *Bos taurus* as figured by Tandler *. But the "waist" of the hourglass, though marking the exit of the ophthalmic †, is opposite to the pituitary body and well behind the origin of the middle cerebral artery. The circle of Willis gives off near to the origin of the middle and anterior cerebrals a branch on each side to the pyriform lobe, concerning the existence of which in the Rodentia mention has already been made. The nature of the anterior cerebral arteries is somewhat remarkable. On the left side this artery runs forward and curves over the corpus callosum in the usual way. As it bends over it gives off a branch running upwards which bifurcates; from the point of bifurcation a twig reaches the right anterior cerebral, or rather a more slender artery running above the left anterior cerebral but not connected with it except as just stated, which seems to me to be the olfactory branch only of the right cerebral. I am inclined, in fact, to look upon the right anterior cerebral as missing and as being represented by the olfactory branch of that artery only. In this case the anterior connection between branches of the right and left anterior cerebrals will not be the equivalent of the anterior communicating artery of other mammals. Finally, I may call attention to a small artery (text-fig. 21, A, *b*, p. 194) which runs from the middle cerebral artery to the anterior cerebral artery of the left side.

Carnivora.—I have examined a considerable number of brains belonging to this order of mammals, which I shall not describe in detail, but concerning which I shall attempt some generalities. A most characteristic feature of the Carnivora, seen also in the Seal (according to Dr. Tandler's figure ‡), is the large size not only of the vertebral arteries but of the anterior spinal. The latter arises, as in Man, &c., by a branch from each vertebral, which speedily unite to form a single trunk running along the anterior face of the spinal cord. The result is a strong rhomboidal-shaped vessel from the lateral angles of which arise the vertebrals. As a rule, that is to say, their origin is from the lateral angle of this "circle," but, as already stated, in *Galictis* they lie much farther back close to the junction of the two "roots" of the anterior spinal artery.

In these features the Carnivora contrast with such other mammals as I have examined, the only type resembling them being, as I have already said, *Tamandua*. So far as my experience goes, the ophthalmic artery generally arises from the circle of Willis anteriorly to the entrance into that circle of the carotid, and in *Ictonyx* quite at the anterior "corner," where the middle and

* *Loc. cit.* p. 776.
† I presume this artery to be the ophthalmic.
‡ *Loc. cit.* pl. v. fig. 19.

anterior cerebral arteries diverge. This was also the case in a brain of *Mustela subpalmata*. On the other hand, in Rodents it at least sometimes is the case that the ophthalmics arise farther back along the circle of Willis; and when, as in the Porcupine (*Hystrix cristata*), a carotid is present and reaches the circle of Willis, it joins the circle at a point considerably anterior to the emergence of the ophthalmic artery.

§ *Anterior Cerebral Artery.*

Tandler, in the memoir referred to, does not pursue the course of the anterior cerebral arteries far beyond their origin from the circle of Willis. That is indeed not his object. I may therefore direct attention to a few facts relating to the distribution of the anterior cerebral artery and its branches. In Man the two anterior cerebrals give off comparatively inconspicuous branches to the anterior lobes of the brain, and themselves form entirely the two arteries which run over the corpus callosum and supply the hemispheres right and left.

The opposite extreme appears to me to be shown in the brain of *Myopotamus* and some other types. In *Myopotamus* (see text-fig. 22, A, p. 195) the anterior cerebral of each side divides early into two branches, of which the inner soon meet and fuse and are continued forward as the at first single but soon double callosal artery. The circle of Willis is thereby completed. The outer of the two arteries presently gives off a branch, on each side of which, as will be seen from the drawing just referred to (text-fig. 22, A, *f*, p. 195), I traced only one—that on the left side—from beginning to end. This artery joins the callosal after its division into the two forwardly running arteries. The callosal arteries are thus formed by two branches arising from the anterior cerebral in *Myopotamus*, and by only one branch in Man. It is possible that the anterior communicating artery of Man represents in a rudimentary way the second and stronger tributary of the callosal artery in the Rodent.

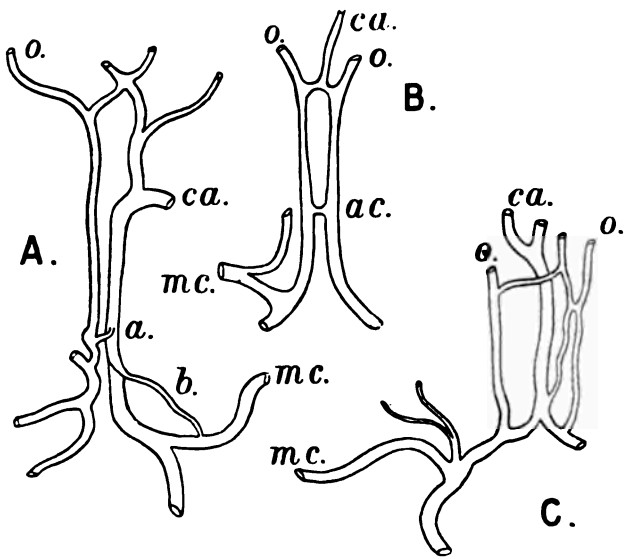
Both of these two types show modifications in other mammals.

In the brain of the diprotodont Marsupial *Bettongia penicillata* the circle of Willis is quite incomplete anteriorly; there is no communication between its two sides—no anterior communicating artery as it is termed in human anatomy. The middle cerebral (the artery running along the Sylvian fissure) joins at an acute angle an artery running forwards, which is evidently the anterior cerebral. This vessel runs on each side close to the interhemispheral edge of the anterior lobe; the two arteries are thus nearly in contact when the brain is undisturbed. These arteries run right forward to the anterior end of the brain, and each gives off at any rate two branches of importance. One of these runs towards the outside of the brain in the furrow below the olfactory bulb. The other branch, arising a little further on and at right angles to the main trunk, passes over the commissural region and supplies

the internal face of the hemispheres as does the main trunk of the anterior cerebral in Man.

In addition to these, a single artery from the left side, arising from the olfactory just after the point where the middle cerebral is given off, approaches and appears to go in the median interhemispheral arteries. The only other brains among the many which I have examined which seem to agree with that of *Bettongia* are those of a Ground-Squirrel (*Xerus erythropus*) and of the Viscacha (*Lagostomus trichodactylus*). In the latter, however, I could find only one of the paired vessels arising far forward along the olfactories and helping to constitute the median interhemispheral callosal; and in the former I could not find either of them. In both, the single inner branch of the anterior cerebral arises from the left side. That it does so in specimens of three species selected at random appears to argue that the condition of asymmetry is normal.

Text-fig. 21.



Anterior cerebral system of (A) *Tragulus meminna*; (B) *Viverra civetta*; and (C) *Gazella rufifrons*.

a., rudimentary callosal of right side (?); *ac.*, anterior communicating artery; *b.*, branch connecting middle and anterior cerebrals; *ca.*, callosal artery; *mc.*, middle cerebral; *o.*, olfactory.

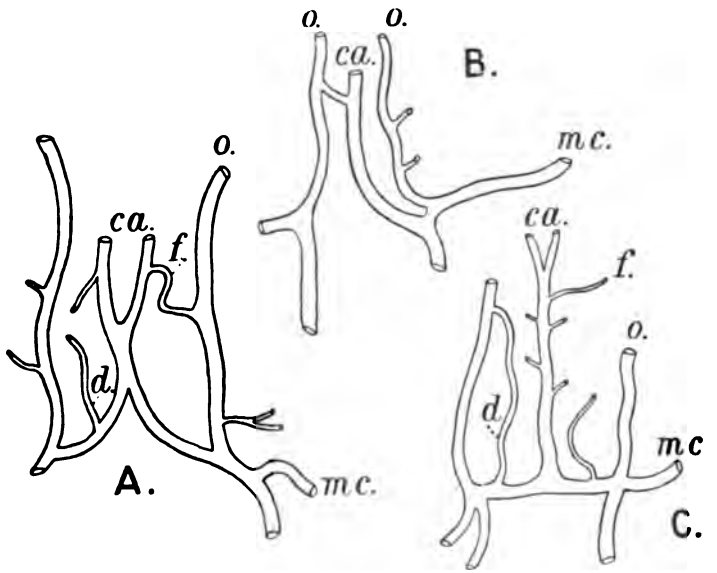
The human type of arterial distribution is to be seen in the Carnivora, that is to say in the Æluroid division of that order. In *Viverra civetta* * (see text-fig. 21, B) the only differences from

* Tandler (*loc. cit.* Taf. iv. fig. 13) does not figure the anterior communicating artery, but states it to be present. I can confirm his statement.

the human arterial arrangement appear to be the long distance from the middle cerebral artery of the anterior communicating artery, and the fact that the two callosals fuse together immediately after their origin from the anterior cerebrals. *Suricata tetradactyla* and *Arctictis* have a cerebral arterial system which is constructed upon the same plan.

It will be remembered * that the cerebral arterial system of Man differs from that of, at any rate, some Apes and Lemurs in the fact that there is an anterior communicating artery and that, apart from this connection, the two callosal arteries remain separate. In the Apes and Lemurs, on the other hand, the two callosal arteries are given off early and immediately fuse to form a single callosal artery which, later, divides. This condition seems to me to be simply an exaggeration of the anterior communicating artery. Now precisely the same thing occurs among

Text-fig. 22.



Anterior cerebral system of (A) *Myopotamus coypu*, (B) *Lagostomus trichodactylus*, (C) *Tamandua tetradactyla*.

For *d* and *f* see text, p. 196. Other letters as in text-fig. 21.

the Carnivora. In the genera *Ursus*, *Ictonyx*, *Galictis*, and *Mustela* the disposition of the callosal arteries is as in the Apes; while, as already mentioned, certain Æluroid genera agree with Man. The classificatory significance of this cannot be passed over; and I would specially direct attention to the fact that the

* See for example Beddard, *suprà*, p. 161.

Binturong agrees with other Æluroids, and that its alleged resemblances to the Arctoidea are not borne out by the facts put forward in the present paper.

As to the Ungulata, my observations refer only to *Tragulus meminna*, *Gazella rufifrons*, and *Hyrax capensis*. The general plan appears to be that of the Carnivora; but, as will be seen in the drawing (text-fig. 21, p. 194), the two former agree in that the callosal gives off to the right side of the brain a supplementary artery which forms a communication or communications with the olfactory artery. It will be seen from the figures referred to that—apart from details—there is a real correspondence in these points between *Gazella* and *Tragulus*.

I may finally call attention to the anterior cerebral artery in *Tamandua*. Whether the branch lettered "*f*" in the drawing (text-fig. 22, C, p. 195) is really the equivalent of that similarly lettered in drawings of other brains or not, I am unable to say, since it was broken off. The arteries "*d*," again, may have their counterpart in that similarly lettered in the figure of the brain of *Myopotamus* (text-fig. 22, A, p. 195).

It is plain from the foregoing series of facts that the callosal artery in those mammals which I have had the opportunity of studying may have one or two sources of origin. In Man and the Primates and in the Carnivora, the callosal artery or arteries arise from the anterior cerebral by one branch on each side, which is sometimes more anterior in position, e. g. *Viverra civetta*, Tiger, or more posterior in position, *e. g.* Man, Apes, and *Ursus syriacus*. The point at which the callosal artery splits off from the anterior cerebral does not seem to be of importance. In the Marsupials and Rodents there is this more anteriorly situated origin; but it is reinforced by a branch or branches (that is one on each side), which arise from the cerebral artery further back, and join the callosal anteriorly.

§ *Conclusions.*

I may briefly state the main conclusions to which the above facts appear to lead.

(1) The much greater proportionate length of the basilar artery in all lower mammals as contrasted with Man and the Primates.

(2) The large size of the anterior spinal artery in Carnivora and in at least some Ungulates as compared with Rodents and Primates. In Carnivora the anterior spinal arises by two trunks—one from each of the vertebral arteries, forming thus a continuous vessel of rhomboidal shape and of approximately equal diameter throughout. In Ungulates there is not always such a connection, but the anterior spinal is generally simply continuous with the basilar, and the vertebrals are small. The existence of the rhomboidal area, of course, is not peculiar to Carnivora; but the equality in calibre of its several component tubes is characteristic.

(3) In Man the middle cerebellar artery arises in front of the sixth nerve. In other mammals the general rule is for this

artery to arise from the basilar behind the sixth nerve. I have noted as exceptions only *Tragulus meminna* and *Gazella rufifrons*, which in this point agree with Man *.

(4) The circle of Willis is generally, but not always, entirely symmetrical in itself and in its branches. When it is incomplete, as e. g. *Hyrax* (posteriorly) and *Lagostomus* (anteriorly), or asymmetrical (*e. g.* ophthalmic artery in *Myopotamus*), the advantage lies with the left side.

(5) A rete is occasionally (e. g. *Tamandua*) formed between the circle of Willis posteriorly and the pituitary body in front.

(6) The brain of *Hyrax* has an arterial system constructed upon the Ungulate plan, and is especially like the Horse.

(7) *Tamandua* shows characters which are elsewhere found in the Carnivora in respect of the rhomboidal area surrounded by equisized vertebral and anterior spinal arteries.

(8) The Arctoid Carnivora can apparently be distinguished from the Æluroid Carnivora by the mode of origin of the callosal arteries. In the former they arise nearer to the circle of Willis and fuse to form a single artery. In the latter the arteries are given off later and do not fuse; but there is a communicating artery which joins the two cerebrals before they give off the callosal. It is clear, therefore, that the circle of Willis may be completed anteriorly by arteries which are not homologous.

3. Descriptions of Three new Fishes discovered by the late Mr. J. S. Budgett in the Niger †. By G. A. Boulenger, F.R.S., V.P.Z.S.

[Received December 17, 1903.]

(Plates VII. & VIII.‡)

Marcusenius budgetti. (Plate VII. fig. 1.)

Depth of body 3 times in total length, length of head 5 times. Head a little deeper than long; snout rounded, $\frac{1}{3}$ length of head; mouth small, inferior, its width $\frac{1}{3}$ length of head; teeth small, notched, 5 in the upper jaw, 6 in the lower; anterior nostril on a line with the lower border of the pupil and equally distant from

* I do not suggest at present that this is an Ungulate character since my material is obviously too scanty. *Hyrax* does not agree with *Tragulus* and *Gazella*.

† This note was intended to supplement an account by Mr. Budgett of his expedition to the Niger in quest of the eggs of Polypterus, which was to have been read before this Society at the January meeting. In the meantime Science has had to deplore the loss of this gifted and courageous zoologist, who died on Jan. 19, on the very evening his paper was announced for reading, from fever contracted on his expedition.—G. A. B.

‡ For explanation of the Plates, see p. 199.

the eye and from th end of the snout; eye longer than the snout, $\frac{1}{4}$ length of head, $\frac{3}{5}$ interorbital width. Dorsal circa 32 *, a little shorter than its distance from the head, longest rays $\frac{3}{5}$ length of head. Anal 25, originating below 11th ray of dorsal, nearer base of caudal than base of ventrals; longest rays $\frac{2}{3}$ length of head. Pectoral pointed, a little shorter than the head, once and $\frac{1}{2}$ the length of the ventral, and extending beyond the vertical of the base of the latter. Caudal with pointed lobes. Caudal peduncle 3 times as long as deep, as long as head. 67 scales in the lateral line, $\frac{17}{17}$ in a transverse series on the body, $\frac{10}{11}$ in a transverse series between dorsal and anal, 12 round caudal peduncle. Pale brownish above, silvery white beneath; head closely dotted with dark brown; a pair of dark brown bars across the nape.

Total length 190 millim.

A single specimen from Assay, Southern Nigeria.

This species is nearly allied to *M. petherici* Blgr., from the Upper Nile, and to *M. psittacus* Blgr., from the Congo.

GNATHONEMUS GILLI. (Plate VII. fig. 2.)

Depth of body $3\frac{2}{3}$ times in total length, length of head $5\frac{2}{3}$ times. Head slightly longer than deep, with curved upper profile; snout $\frac{1}{3}$ length of head; mouth small, on a line with the lower border of the eye; chin with a globular dermal appendage; teeth minute, conical, 3 in the upper jaw, 4 in the lower; eye a little shorter than snout, $4\frac{1}{2}$ times in length of head, once and $\frac{1}{2}$ in interorbital width. Dorsal 33, its origin corresponding to that of the anal, its length once and $\frac{1}{2}$ in its distance from the head. Anal 31, equally distant from base of ventrals and from base of caudal. Longest rays of dorsal and anal $\frac{2}{3}$ length of head. Pectoral pointed, as long as the head, once and $\frac{3}{4}$ as long as the ventral, reaching beyond the base of the latter. Caudal scaled in its basal half, with pointed lobes. Caudal peduncle 4 times as long as deep, slightly longer than the head. 85 scales in the lateral line, $\frac{25}{25}$ in a transverse series on the body, $\frac{21}{21}$ in a transverse series between dorsal and anal, 14 round caudal peduncle. Brown above, silvery white beneath; dorsal and anal fins greyish brown in front.

Total length 245 millim.

A single specimen from Assay, Southern Nigeria.

This new Mormyr, named in honour of the founder of the genus *Gnathonemus*, Dr. Theodore Gill, of Washington, occupies an intermediate position between the species in which the anal fin originates in advance of the dorsal (*G. cyprinoides* L., *mento* Blgr., *monteiri* Gthr., &c.), and those in which the reverse is the case (*G. ussheri* Gthr., *greshoffi* Schilth.).

* The dorsal was injured during life in the specimen here described.

SYNODONTIS RESUPINATUS. (Plate VIII.)

Depth of body twice and $\frac{1}{3}$ in total length, length of head 4 times. Snout rounded, smooth, as long as the postocular part of the head; interorbital region very convex, feebly granular, its width $\frac{1}{3}$ length of head; eye supero-lateral, its diameter 4 times in length of head; maxillary barbel slightly longer than the head, its basal third with a broad fringe and short obtuse branches, some of which are knob-like; mandibular barbels with long, arborescent branches; outer mandibular barbel $\frac{1}{2}$ length of head, inner $\frac{1}{3}$; lips strongly developed. Præmaxillary teeth very small, villiform, forming a broad band; outer mandibular teeth about one-fourth the diameter of the eye, about 60 in number. Occipito-nuchal shield obtusely tectiform, finely granulate like the back of the skull, with obtuse posterior processes. Gill-opening not extending below beyond the level of the pectoral spine. Humeral process not keeled, obtusely pointed, finely granulate, not extending quite so far back as the nuchal process. Dorsal fin I 7; spine as long as the head, striated, not serrated, with a very long filamentous prolongation. Adipose fin twice and $\frac{1}{2}$ as long as deep, commencing immediately behind the rayed dorsal. Anal fin IV 8, pointed. Pectoral spine as long as the head, striated, feebly serrated on outer edge, strongly on inner, not quite reaching the ventral fin. Latter extending to origin of anal. Upper caudal lobe much produced. Skin smooth, not villose. Pale greyish brown above and on the sides, black beneath; fins grey; barbels whitish.

Total length 260 millim.

This very remarkable species, of which a single specimen was obtained at Lokoja, Northern Nigeria, agrees with *S. membranaceus* Geoffr. and *S. batensoda* Rüpp., in having the lower parts darker than the upper; but it differs from them, as well as from all other species, in having short branches on the maxillary barbels in addition to the fringe.

EXPLANATION OF THE PLATES.

PLATE VII.

Fig. 1. *Marcusenius budgetti*, p. 197. $\frac{1}{2}$ nat. size.
2. *Gnathonemus gilli*, p. 198. $\frac{2}{3}$ nat. size.

PLATE VIII.

Synodontis resupinatus, p. 199. $\frac{1}{2}$ nat. size; with view of open mouth, nat. size.

4. On the Type Specimen of a West African Fish, *Clarias læviceps* Gill. By G. A. Boulenger, F.R.S., V.P.Z.S.

[Received January 9, 1904.]

The name *Clarias læviceps* was introduced by Gill in Proc. Ac. Philad. 1862, p. 139, for a small fish in the Collection of the Smithsonian Institution, bearing no indication of locality, but regarded as probably from Liberia. The definition is given in the following words:—"Height at anus a tenth of length; head (laterally) a sixth; its breadth an eighth; the surface smooth; maxillary barbels twice as long as head. D. 86. A. 61."

In a genus represented in West Africa by so many closely allied species, so brief a definition could hardly answer its purpose, and *Clarias læviceps* has proved a stumbling-block to workers at African ichthyology. Sauvage recognised the species in a specimen from the Gold Coast; Günther suggested its identity with *C. bythipogon* of Sauvage; and I myself proposed to regard it as a synonym of *C. salæ*, described by Hubrecht from Liberian specimens. But all this was mere guesswork, and lately, when describing another close ally, under the name of *C. pachynema*, I felt it imperative to settle the matter by an appeal to the type specimen preserved in the U.S. National Museum.

I am glad to say that my application was granted, in a most courteous manner, by the Assistant Secretary of that Institution, notwithstanding the rule that unique type specimens are not to be sent on loan. I must add that the exception made in my favour is greatly due to the kind advocacy of Dr. Theo. Gill, the original describer of the specimen. I beg to tender my sincere thanks to the authorities of the Smithsonian Institution and to Dr. Gill for their great kindness.

I here give a description of the type of *C. læviceps*, followed by a comparative description of three further specimens, viz. the types of *C. kingsleyæ* Gthr., and the specimen from Assini, Gold Coast, correctly identified by Sauvage.

Clarias læviceps.

Gill, Proc. Ac. Philad. 1862, p. 139.

Depth of body $8\frac{2}{3}$ times in total length, length of head 5 times. Head once and $\frac{1}{5}$ as long as broad, smooth; occipital process pointed; frontal fontanelle sole-shaped, not quite twice as long as broad; occipital fontanelle smaller, in advance of occipital process; eye very small, 3 times in length of snout, 6 times in interorbital width, which equals half length of head and a little exceeds width of mouth; band of præmaxillary teeth 5 times as long as broad; vomerine teeth conical, forming a curved band which is a little narrower than the præmaxillary band; barbels rather thin, nasal nearly half length of head, maxillary once and $\frac{2}{5}$, outer mandibular once, inner mandibular not quite $\frac{2}{3}$. Gill-rakers few, about 20 on first arch. Clavicles concealed under the skin. Dorsal fin 87, its

distance from the occipital process ½ length of head. Anal fin 70. Dorsal and anal fins extending almost to the very root of the caudal, the space separating them from the latter being less than the diameter of the eye. Pectoral fin nearly ⅔ length of head, the spine feebly serrated on the outer side and ¾ the length of the fin. Ventral fins once and ½ as far from the base of the caudal fin as from the end of the snout. Caudal fin a little more than ½ length of head. Uniform brown in spirit (bleached).

Total length	194	millim.
Depth of body	20	,,
Length of head	35	,,
Width of head	26	,,
Diameter of eye	3	,,
Interorbital width	17	,,
Width of mouth	15	,,
Nasal barbel	16	,,
Maxillary barbel	56	,,
Outer mandibular barbel	36	,,
Inner ,, ,,	21	,,
From end of snout to ventral fins	70	,,
From occiput to dorsal fin	17	,,
Pectoral fin	21	,,
Ventral fin	11	,,
Caudal fin	20	,,

Description taken from three further specimens.

Clarias læviceps Sauvage, Bull. Soc. Zool. France, 1882, p. 318, pl. v. fig. 2.

Clarias kingsleyæ Günther, P. Z. S. 1902, ii. p. 334.

Depth of body 8½ to 12 times in total length, length of head 5 to 5½ times. Head once and ⅓ to once and ⅓ as long as broad, smooth; occipital process pointed; frontal fontanelle sole-shaped, at least twice as long as broad; occipital fontanelle smaller, in advance of occipital process; eye very small, 3 to 4 times in length of snout, 6 to 7 times in interorbital width, which equals half length of head and a little exceeds width of mouth; band of præmaxillary teeth 4 to 5 times as long as broad; vomerine teeth conical, forming a curved band which is as broad as or a little narrower than the præmaxillary band; barbels moderately thick, ⅗ to ⅔ length of head, maxillary once and ⅓ to once and ½, outer mandibular once, inner mandibular ⅔. Gill-rakers few, 15 to 20 on first arch. Clavicles concealed under the skin. Dorsal fin 79–87, its distance from the occipital process ½ to ⅔ length of head. Anal fin 68–78. Dorsal and anal fins extending almost to the very root of the caudal. Pectoral fin ⅗ length of head, the spine feebly serrated on the outer side and ⅔ to ¾ the length of the fin. Ventral fin once and ⅔ as far from the base of the caudal as from the end of the snout. Caudal fin ½ to ⅔ length of head. Uniform dark brown above, light brown beneath, in spirit.

Gold Coast.—The largest specimen measures 270 millim.

5. On the Subspecies of *Giraffa camelopardalis*.

By R. LYDEKKER.

[Received November 27, 1903.]

(Plates IX.–XVI.* and Text-figures 23–37.)

The bringing of the present communication to the notice of the Zoological Society has been to some extent an almost involuntary act on my part, and due rather to the force of circumstances than to any desire to add to the burden of zoological nomenclature.

Some time ago the British Museum received the skins of a pair of giraffes which had been shot by Major Powell-Cotton in East Africa, and are now mounted and exhibited to the public; and it became my duty to give them names.

As is well known, the recognition of distinct forms of Giraffe is no new event. Mr. de Winton, in a communication to the Society† some years ago, recognised two species and one subspecies from the northern, eastern, and southern districts of the African continent, namely *Giraffa camelopardalis*, *G. c. reticulata*, and *G. capensis*. Later on Mr. Thomas‡ regarded *reticulata* as a distinct species, and relegated *capensis* to the rank of a race of *camelopardalis*. Two other forms have also been described by Dr. P. Matschie from East Africa.

I found myself unable to identify the Museum specimens with any of these named forms, *stricto sensu*. Consequently a revision of the whole group was necessary.

With some trouble I have succeeded in obtaining a collection of paintings and photographs of these animals (which I intend to present to the Museum) such as I think has never previously been brought together. And I may here express my indebtedness to our President for his liberality in defraying the cost of these paintings.

I have previously given a preliminary account of some of the new forms, now more fully described, in a popular journal§, but the acquisition of yet other specimens by the Museum has induced me, largely owing to the advice of my friend Mr. Thomas, to lay the results of my investigations before the Society.

I may add that whatever may be the general opinion as to the advisability or otherwise of naming local subspecific forms of animals, there is an instance precisely analogous to the present one in the case of the Bonte-Quagga, or Burchell's Zebra (*Equus burchelli*); and that if the local phases of the latter are thought worthy of recognition, most certainly the same recognition should be accorded to the local forms of Giraffe. But I may go further than this and add that, so far as I know, whereas the local forms of the Bonte-Quagga are distinguished solely by colour and markings, most, if not indeed all, of the subspecies of Giraffe are distinguishable by cranial differences. Nor is this all, for one of the

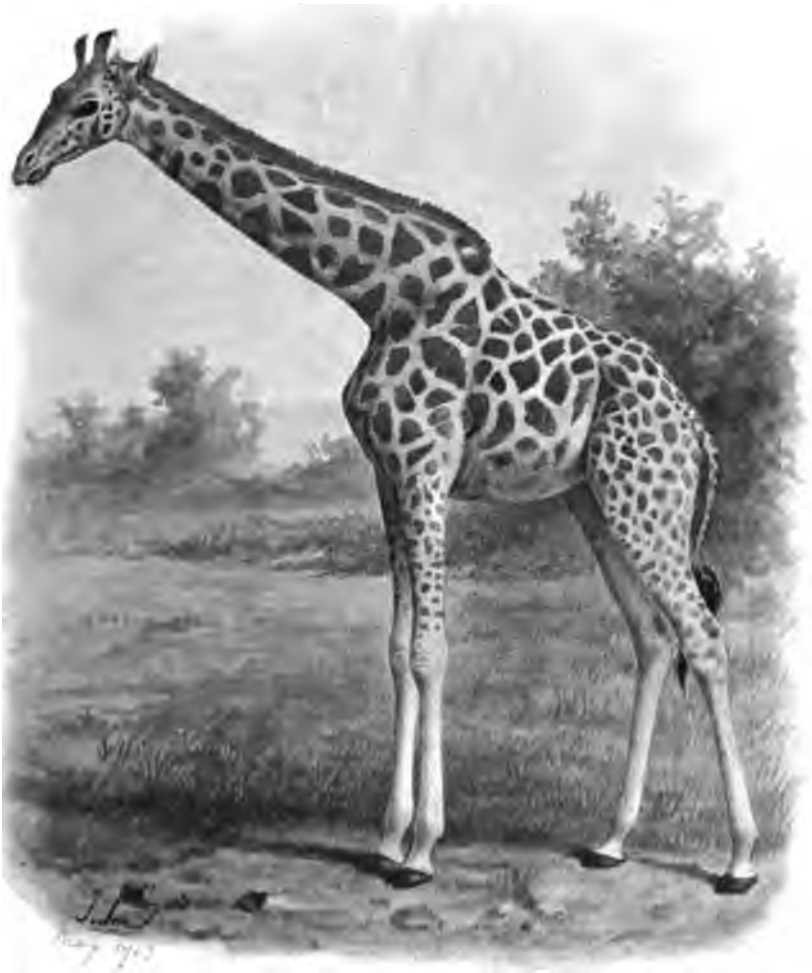
* For explanation of the Plates, see p. 227.

† P. Z. S. 1897, p. 277. ‡ *Ibid.* 1901, vol. ii. p. 474.

§ 'Animal Life and the World of Nature,' vol. ii. p. 78.

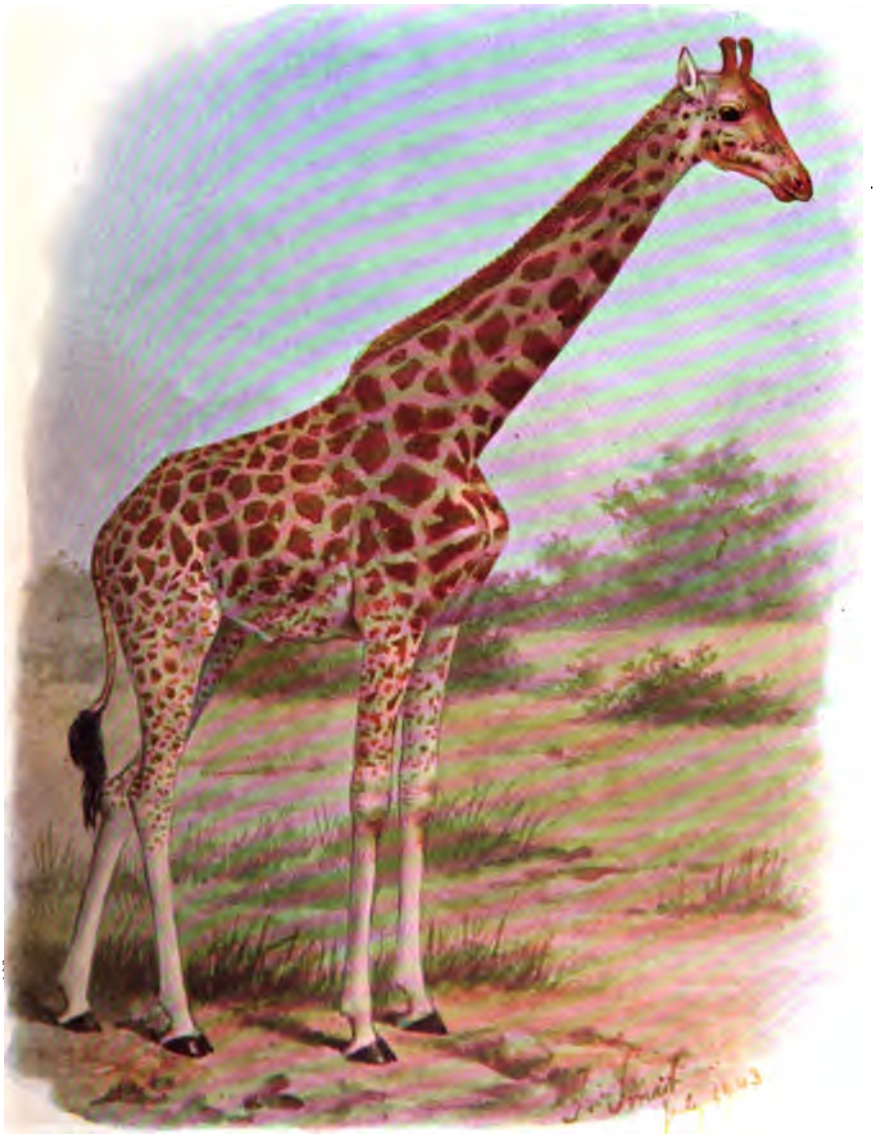
Andre and Sleigh, Limited.

Giraffa Camelopardalis Typica, ♂ Jr.



Andre and Sleigh, Limited.

Giraffa Camelopardalis Typica, ♀ Jr.



Andre and Sleigh, Limited.

Giraffa Camelopardalis Antiquorum, ♂ Jr.

Andre and Sleigh, Limited.

Giraffa Camelopardalis Rothschildi, ♂

Andre and Sleigh, Limited.

Giraffa Camelopardalis Rothschildi, ♀.

Andre and Sleigh. Limited.

Giraffa Camelopardalis Angolensis, ♂

Andre and Sleigh, Limited.

Heads of (1) Giraffa Camelopardalis Cottoni and (2) G.C.Wardi.

Andre and Sleigh, Limited.

Giraffa Camelopardalis Capensis, ♂

local forms of the Bonte-Quagga, which apparently grades imperceptibly into the typical race, has been accorded (although I think wrongly), in a late issue of the Society's 'Proceedings'*, specific rank.

I should mention that I am much indebted to Mr. Rowland Ward, of 166 Piccadilly, and his staff in connection with the subject of this paper, which indeed could scarcely have been written at all apart from their valuable assistance.

Before proceeding to the descriptive part of my subject, I may take the opportunity of recording a few general remarks with regard to the local races of *Giraffa camelopardalis*, the geographical range of which once extended from, or nearly from, the Cape to the Egyptian Sudan and Abyssinia. Two features are noteworthy in regard to these local forms, some of which probably intergrade.

Firstly, we notice as we proceed from south to north the gradual passage of a two-horned animal into one (so far as the males are concerned) with three horns. But the development is by no means simply progressive, for we find in the eastern districts of the continent a tendency to the formation of a five-horned, and even of a six-horned, race.

Secondly, proceeding in the same direction, a transition is observable from a blotched animal (that is to say, one with irregular dark chocolate-coloured blotches on a tawny ground) with dark legs spotted down to the hoofs, to one in which the markings take the form of a white or buffish network on a chestnut or liver-coloured ground, while the lower portion of the legs becomes unspotted white; the culmination of this type being presented by the Somali *G. reticulata*. Here, however, as in the case of the horns, the progression is by no means regular, since we find in East Africa a strong tendency to the development of a star-like type of coloration. Indeed, it would seem that in this part of the continent Giraffes have, so to speak, got completely off the line, and run riot, both in the matter of coloration and horn-development.

By no means the least noteworthy feature in regard to the change of the type of coloration in Giraffes as we proceed from South to North-east Africa, is that it is precisely the reverse of that among the Quaggas and Bonte-Quaggas. That is to say, that whereas among the various races of Giraffe the general colour lightens and the legs pass from spotted to pure white as we go from south to north, among the local forms of *Equus burchelli* the stripes on the legs, underparts, and hind-quarters, which are fully developed in the northern types, such as *E. burchelli granti*, have disappeared more or less completely in the southern forms, the supreme development in this respect being reached by the true Quagga (*E. quagga*).

In the case of the Quagga-group, a satisfactory and sufficient explanation of the reason for the colour-change has, I think, been given by Mr. Pocock †. As regards the cause of the change in the reverse direction presented by the Giraffes, I have not hitherto

* P. Z. S. 1901, vol. ii. p. 503, pl. xxix. † 'Nature,' vol. lxviii. p. 356 (1903).

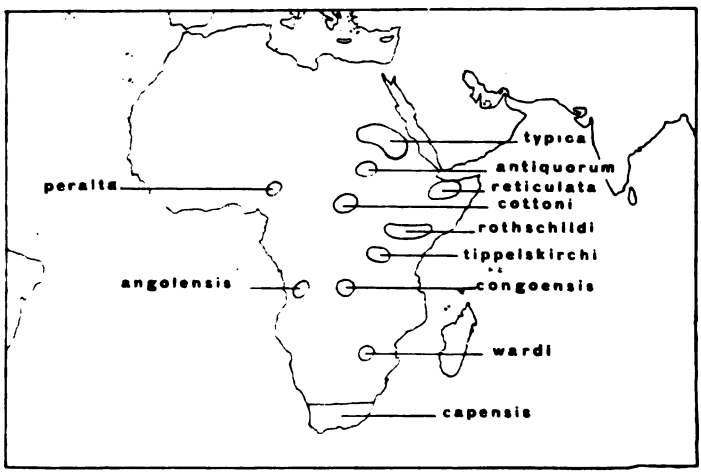
been able to obtain any clue. It is, however, quite certain that there must be some good reason for the change, and it is largely in the hope that the facts recorded in this communication may help to solve the problem that I have brought them to the notice of the Society. As I have stated on previous occasions, the mere description of local colour-phases of animals is, in my opinion, a waste of energy unless it lead to some general conclusion in regard to the reason for such modifications.

Another noteworthy feature in connection with coloration is that whereas some of the northern forms of Giraffe have the front of the face more or less feebly spotted, in the southern forms it is always uniformly coloured.

At present I am able to recognise the following forms of Giraffe, the typical distributional areas of which are indicated on the accompanying map:—

A. Netted Giraffe	*Giraffa reticulata* *.
B. Blotched „	„ *camelopardalis.*
1. Nubian Giraffe.....	*G. c. typica.*
2. Kordofan „	„ *antiquorum.*
3. S. Lado „	„ *cottoni.*
4. Baringo „	„ *rothschildi.*
5. Kilimanjaro „	„ *tippelskirchi.*
6. Congo „	„ *congoensis.*
7. Angola „	„ *angolensis.*
8. N. Transvaal „	„ *wardi.*
9. Cape „	„ *capensis.*
10. Nigerian „	„ *peralta.*

Text-fig. 23.



Map of Africa, showing distribution of Giraffes.

* I reserve the point as to whether a transition between this and the next may not exist.

A. *With a large frontal horn.*

a. Fore legs white and unspotted from below the knee; front part of face sometimes spotted.

1. NUBIAN GIRAFFE.

GIRAFFA CAMELOPARDALIS TYPICA. (Plates IX. & X.)

Cervus camelopardalis Linn. Syst. Nat. ed. 12, vol. i. p. 98 (1766).

Hab. Upper Nubia and Abyssinia.

Sexes nearly or quite alike in respect to form and colour of markings.

Spots large, apparently chestnut-coloured at all ages, more or less distinctly quadrangular in form, and divided by a coarse network of comparatively narrow light lines, which are buffish white in immature bulls, and nearly white in cows of same age. Front of face in bulls somewhat spotted, and sides fully spotted.

No prominent occipital (posterior) horns.

In the immature male figured in Pl. IX. a notable feature is a row of five large spots, of which the first is partially divided, extending from just below the point of the shoulder in a curved line to the middle of the back. On the outer side of the fore-limb the spots extend well down to the knee, and in the hind-limb a considerable distance down the cannon-bone. The under-parts are comparatively free from spots, as is the inner surface of the upper segments of both limbs.

In the female (Pl. X.) the spots are smaller and more numerous, this being especially noticeable on the hind-quarters and the upper part of the fore-legs. Correlated with this is the greater width of the light interspaces, which are nearly white on the greater part of the body. Faint spotting occurs on the belly and the fore part of the inner surface of the front legs.

It is important to notice that the general pattern of the coloration is the same in both sexes.

There is at present living in the collection at Woburn Abbey an immature male Giraffe from Abyssinia of about the same apparent age as the younger of the two females from the Sudan, which were purchased at the same time as the bull shown in Plate IX. With the exception that the forehead is decidedly lighter in colour, and that there are much fewer spots on the sides of the face, this young male accords in general characters and colour with the typical Nubian race, from which I see no reason to separate the Abyssinian form. A male skeleton in the British Museum shows that when adult the front horn in the Abyssinian Giraffe is fully developed. A photograph of a pair of Abyssinian Giraffes lately imported by Mr. Menges shows the type of coloration.

2. KORDOFAN GIRAFFE.

GIRAFFA CAMELOPARDALIS ANTIQUORUM. (Plate XI.)

Camelopardalis antiquorum Jardine, 'Naturalist's Library,' vol. xxi. p. 187, pl. xxi. (1838).

Hab. Kordofan.

Nearly allied to the last race, from which it is easily distinguishable by the circumstance that in the fore-limb from just above the line of the abdomen, and on the hind-limb halfway up the thigh, the spots suddenly break up into a series of very small spots of irregular shape, similar spots occurring on the underparts and inner side of limbs. Horns as in the Nubian Giraffe.

Text-fig. 24.

Male Kordofan Giraffe. (From Jardine.)
The frontal horn is not shown.

Jardine's type specimen (an adult bull), of which the figure is reproduced in the accompanying text-fig. 24, and the young male and female now in the Society's Gardens* agree in the above-mentioned feature.

* See P. Z. S. 1902, ii. p. 225.

[Since this paper was written, I have received a letter from Captain Stanley Flower, of Giza, directing my attention to the difficulty of defining the habitat of this race from that of the typical form. Giraffes being unknown in Lower Nubia, I can only presume that *typica* comes from the Abyssinian, or Kassala, side of Upper Nubia (Egyptian Sudan). A photograph of a female Kordofan Giraffe sent by Capt. Flower agrees with the specimens mentioned above with respect to the spotting of the limbs. The spots on the shoulders and neck differ, however, from those in the London specimens by their more jagged contour and the wider intervals between them, this being doubtless due to the greater age of the specimen. This specimen serves to confirm the distinctness of this race from *typica*, although approximating it to *cottoni*.]

3. South Lado Giraffe.

GIRAFFA CAMELOPARDALIS COTTONI. (Plate XV. fig. 1.)

Hab. That portion of the interior of Uganda lying immediately south of Lado, which is itself 5° north of the equator.

Major Powell-Cotton informs me that this Giraffe was shot on March 15th, 1903, on Koten plain, at an elevation of 2550 feet. Koten lies to the extreme south of the Topora (Doborsa of the maps) country, and is about 3° 50′ N. by 34° 30′ E. I might have called it the Topora (or Doborsa) Giraffe, but have preferred to associate it with Lado as being a much better known locality, despite the fact that the latter is generally connected with the Congo side of the Nile.

Apparently very closely related to the Baringo race, from which (judging from the single example available) the male differs in the following points:—

The spots on the neck are deep chestnut-brown instead of black, and show no tendency to split up into smaller spots by the development of lighter lines radiating from the centre. Moreover, the spots themselves are of more regular and more squared form, those on the lower part of the neck being so arranged that the fawn-coloured interspaces form continuous transverse bands. In *G. c. rothschildi*, on the other hand, the spots on the neck of the male are arranged somewhat alternately, so that no such transverse light bands can be traced.

The spotting of the face is confined to an area lying considerably below a longitudinal line drawn through the eye. The spots between the eye and the ear are smaller, and do not extend upwards on to the horns; while the hind aspect of the horns and the portion of the crown of the head below them are likewise devoid of spots, although fully spotted in the Baringo race. The white area on the side of the head is also much smaller and much less conspicuous than in the type male of the latter. Moreover, the spots on the under surface of the head (inter-ramine area) are much less numerous, and (like the sides of the face) brown

instead of black. There are also much smaller spots on the nape of the neck.

So far as can be determined, the spots on the shoulder are very much smaller than in the complete Baringo male, none of them approaching in size the few large ones so characteristic of that animal. On both sides of the upper part of the fore-leg the spots are very markedly smaller and more numerous than in the latter; while on the front and inner sides they are pale fawn, instead of being, as on the outer side, black *.

The main horns are decidedly smaller than in the males of the Baringo Giraffe, and the development of the posterior horns is also somewhat less. In the skull of the type and only known specimen, the right main horn is decidedly larger than the left horn. A much more remarkable feature is the presence of a horn projecting horizontally outwards from the middle of the frontal border of the right orbit, this horn being apparently capped by a distinct epiphysis. No trace of any such horn is observable

Text-fig. 25.

Right lateral view of skull of male South Lado Giraffe, showing azygous orbital horn (*a*).

on the left orbit. I am informed by Major Powell-Cotton that all the male Giraffes from the locality in question seem to be furnished with a similar right orbital horn. The same gentleman also tells me that in some specimens of the Baringo Giraffe a similarly-placed horn occurs on the left side. There is, however, no trace of any such horn in any of the skulls of that race in the Museum.

The skull also differs from that of an old male Baringo Giraffe by its lower and narrower form, and more especially by the

* Already the spots on the inner side of the right fore-leg of the male Baringo Giraffe in the Museum, which is exposed to the light, have faded from black to grey or tawny.

absence of the marked lateral expansion of the premaxillary region characteristic of the Baringo Giraffe; the borders of these bones in the present form being nearly straight, instead of markedly bowed.

Such appear to be the chief distinctive features of this Giraffe, so far as I am enabled to formulate them from the specimens at present available. These comprise the skull, the mounted head and neck, several pieces of skin from the fore-quarters, and the mounted right fore-leg: all belonging to a fully adult bull shot by Major P. H. G. Powell-Cotton, at the locality above mentioned, to the southward of Lado, in Northern Uganda, and by him presented to the British Museum, where the head and neck are now exhibited to the public.

As already mentioned, the general characteristics of this Giraffe affiliate it very closely to *G. c. rothschildi*, and I have experienced some difficulty in deciding whether or no it should be subspecifically separated from that form. Premising that my comparisons are based only on a single specimen, and are therefore of necessity somewhat provisional and liable to revision, I cannot identify the South Lado with the Baringo Giraffe; and I therefore propose to regard the former as the representative of a distinct local race, which may be appropriately named after its enterprising discoverer, *Giraffa camelopardalis cottoni*.

Apart from the peculiarities of the skull,—in regard to the importance, or otherwise, of which, I am somewhat uncertain—I am disposed to consider this Giraffe as a distinct race mainly from the general tone, form, and mode of arrangement of the spotting, laying special stress on the absence of spots on the face above (or in front of) a line connecting the eye with the angle of the mouth, and also on the colour, size, and number of the spots on the nape of the neck and on the fore-limb.

It is true that as regards the absence of spotting on the frontonasal region of the face, this feature is paralleled in the mounted head of *G. c. rothschildi* obtained by Sir H. Johnston near Mount Elgon. That head (text-fig. 26, p. 211), as mentioned below, belongs, however, to a very old animal, and is remarkable for the very dark colour of the areas between the spots. And it is, I think, perfectly clear that with this darkening the spots (of which there are still faint traces) have disappeared from this part of the face. Moreover, there is no distinct light line marking the cessation of the spotted area, which is so conspicuous in the present animal. The bull in the Museum from the Quashengeshu Plateau, and the Mount Elgon bull of *G. c. rothschildi*, the sketch of which by Sir H. Johnston is reproduced in text-fig. 27, p. 213, appear to be of about the same age as the South Lado specimen; and the contrast between the fully-spotted faces of the two former and the partially-spotted face of the last is, in my opinion, too great to permit of their being regarded as referable to one and the same subspecies.

It should, moreover, be borne in mind that we are at present

unacquainted with the female of the South Lado Giraffe, and that when this is known it may turn out that the difference in the coloration of the two sexes may be much less pronounced than in the Baringo race.

Indeed, the general type of coloration of the South Lado Giraffe is suggestive of a transition from the Baringo form in the direction of the Kordofan Giraffe (*G. c. antiquorum*), in which both sexes are coloured practically alike. In the absence of spotting on the fronto-nasal region of the face, the South Lado Giraffe approximates indeed to the Kordofan animal, as it does in the small size of the spots on the legs. Not that I think there is much likelihood of the South Lado animal proving to be identical with the Kordofan Giraffe; the colour and arrangement of the spots being apparently somewhat different in the two, while there is no evidence (judging from that of its near relative, the Nubian Giraffe) that the skull of the Kordofan race has either the rudimentary occipital horns or the azygous right orbital horn of the type specimen of the present form.

4. Baringo Giraffe.

Giraffa camelopardalis rothschildi. (Plates XII. & XIII.)

Giraffa camelopardalis rothschildi Lydekker, Hutchinson's Animal Life, vol. ii. p. 122 (1903).

Hab. The Lake Baringo district and thence eastwards to Mount Elgon, both of which localities lie less than 1° north of the equator.

A three-horned Giraffe in which the sexes, in the early adult condition at least, are markedly different as regards both the form and the colour of the spots, with the lower part of the legs pure white and unspotted, a triangular white area in the neighbourhood of the ear, the spots in adult bulls (Pl. XII.) large and very dark-coloured, showing a tendency to split up into stars, as indicated by lighter tripartite radiating lines in the larger ones, and the light interspaces yellowish fawn, forming narrow network-lines on the body, but becoming much broader on the neck, where the spots assume a more irregular and somewhat jagged contour. Above the knees and hocks the spots are chestnut, these chestnut spots extending higher up on the hind than on the fore limbs. Sides of face fully spotted with black.

In females (Pl. XIII.) the spots are much more irregular, jagged, and star-like, reddish chestnut in colour upon a light orange-fawn ground. The light areas on the neck very wide, and the spots on the legs very small, white area round ear small; sides of face sparsely spotted *.

Five horns generally or invariably present in old bulls, owing to the development of the posterior, or occipital, pair.

* Capt. Flower has sent me the photograph of a female Giraffe, said to have come from near Kassala, marked like this specimen. The suggestion arises that it was brought from further south.

The type of this race is the mounted adult bull in the British Museum, shot by Major Powell-Cotton on the Quashengeshu (pronounced Washengeshu) Plateau to the east of Lake Baringo, from which it is separated by a forest-clad mountain-range.

The mounted head and neck (as well as the skull) of the "five-horned" bull Giraffe in the British Museum (text-fig. 26), brought from Mount Elgon by Sir H. Johnston and already alluded to.

Text-fig. 26.

Head and neck of old bull Baringo Giraffe, showing the five horns.
(From the 'Guide to Mammalia in British Museum.')

doubtless belongs to this form. It is true that the whole colour is much darker, the white area below the ear smaller and less distinct, and the spotting on the face much less developed; but in another specimen from the same locality, figured by Sir H. Johnston in 'The Uganda Protectorate' and herewith reproduced (text-fig. 27, p. 213), these features are much the same as in the

type. I attribute, therefore, these differences to individual variation and age, as I likewise do the more pronounced development of the posterior horns. As already mentioned, some of the bulls of this race, according to Major Powell-Cotton, show a protuberance above the left eye. I am informed by the same gentleman that some full-grown bulls are decidedly lighter than the type, and exhibit more distinctly star-like and irregular spots.

When I described the type male I was of opinion that the mounted female in the British Museum, killed by Major Powell-Cotton near Lake Baringo, belonged to a distinct race. I am told, however, by him that bulls precisely similar to the type Quashengeshu specimen occur with the Lake Baringo herd; and this statement is fully confirmed by a male skin from that district I have had the opportunity of inspecting. The marked discrepancy in the coloration of the two sexes is therefore a very distinctive feature of this race of Giraffe at this age.

Sir Harry Johnston (to whom I am indebted for permission to reproduce this illustration) tells me that the individual from which the sketch was taken was a young animal, and that the mounted head in the Museum is, as I have surmised, that of a very old bull; the darker colour and disappearance of the spots in the latter thus being due to age.

Sir H. Johnston further informs me that a very aged female, shot in the same district by his assistant, the late Mr. Doggett, was remarkable for its exceedingly dark colour. So dark, indeed, was this animal, that at a distance it appeared quite a uniform sepia-tint. This indicates that the mounted female in the Museum, although full-grown, is a comparatively young animal. When seen through field-glasses by Sir H. Johnston's party, both males and females of this race of Giraffe were often so dark in colour that they appeared to be nearly black, with white bellies and legs; this deepening of coloration being, as I have said, apparently coincident with advanced age.

From the strong spotting of the face in young adult bulls, this race might well be called the Spotted-faced Giraffe.

I may add a word as to the name given to this race. As the first specimen received in England was brought home by Sir Harry Johnston, the natural course would have been to name it after that gentleman. Since, however, his specimens did not include the entire skin, they did not afford sufficient characters for the definition of this form. On the other hand, it would have been somewhat invidious to name this form after its second discoverer, Major Powell-Cotton. Accordingly it appeared advisable to name it after the donor to the British Museum of the Quashengeshu bull, which first afforded decisive characteristics.

It would not be fair to leave this part of the subject without directing attention to the important service to zoological science Major Powell-Cotton has rendered by collecting these and other specimens of Giraffes from East Central Africa, under what I am given to understand were circumstances of special difficulty.

Text-fig. 27.

Head and neck of a younger male Baringo Giraffe.
(From Sir H. Johnston's 'Uganda Protectorate'—Hutchinson & Co.)

b. The lower part of the legs—especially the hind pair—more or less spotted and dark-coloured.

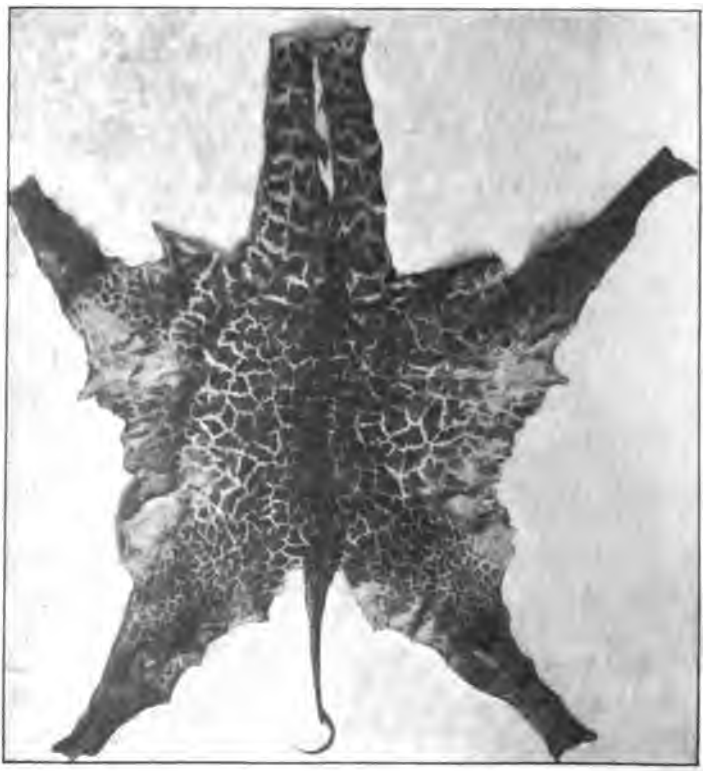
5. Kilimanjaro Giraffe.

GIRAFFA CAMELOPARDALIS TIPPELSKIRCHI.

Giraffa tippelskirchi } Matschie, SB. Ges. naturfor. Berlin,
Giraffa schillingsi } 1898, p. 77.

Hab. Typically Lake Eyassi, to the south-west of the Victoria Nyanza, but extending due westward to the neighbourhood of

Text-fig. 28.



Type skin (young female), from Lake Eyassi, of Kilimanjaro Giraffe (*G. tippelskirchi* Matschie).

Mount Kilimanjaro, in about lat. 3° south of the equator. Also the Masai country, a little further north. Probably extending southwards into Portuguese East Africa.

An apparently lighter-coloured three-horned Giraffe than *G. c. rothschildi*; the sexes nearly alike in the form and colour of the spots, the lower part of the legs (at least generally) more or less spotted and either whitish or olive-coloured. The spots in both sexes very irregular and jagged in contour, often displaying a distinctly star-like shape.

Text-fig. 29.

Anterior part of skin of female Kilimanjaro Giraffe (type of *G. schillingsi* Matschie), from Kilimanjaro district.

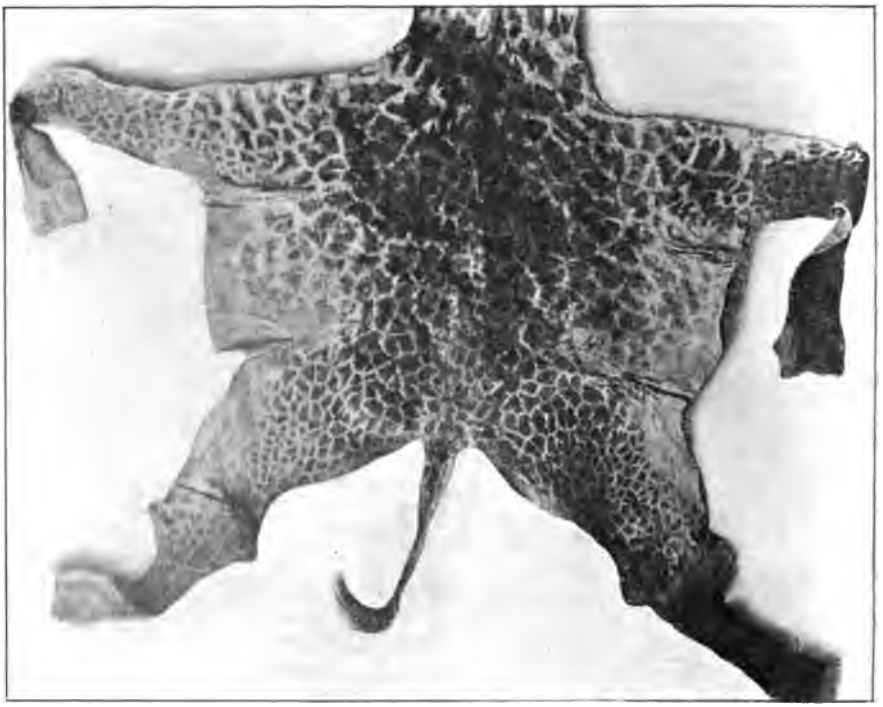
It is not known whether or no the posterior, or occipital, horns are developed.

As regards the history of this form, it may be mentioned as an

unfortunate circumstance that the type specimens of both *tippelskirchi* and *schillingsi* have never hitherto been figured. Had this been done in the first instance, much trouble and confusion would have been saved.

The type of *tippelskirchi* is a young female skin (text-fig. 28, p. 214) brought to Berlin by Mr. Tippelskirch from Lake Eyassi. It is characterised by the dark forehead, olive-coloured and spotted legs, and the very narrow and serrated white lines dividing the spots—the latter feature being evidently due to immaturity.

Text fig. 30.



Hinder portion of skin of specimen shown in preceding figure.

A somewhat older skin, brought by Mr. Ramsay from German East Africa, was regarded by Dr. Matschie as closely allied, but, owing to the lower part of the legs being white, was not definitely assigned to this form.

On the other hand, the type of *schillingsi* is an adult female skin (text-figs. 29 & 30) obtained by Mr. Schillings from the

Kilimanjaro district. It is characterised by the white, unspotted legs, the light forehead, sparsely-spotted cheeks, and the jagged, irregular, and somewhat star-like form of the chestnut spots, which are widely separated on the neck.

Text-fig. 31.

Female Kilimanjaro Giraffe at Karlsruhe*.

A female skin (text-fig. 31) from German East Africa, mounted in the Museum at Karlsruhe, has been identified by Dr. Matschie

* In this figure the spots on the neck appear larger and less jagged than on the opposite side of the neck, as shown in another photograph, where they are similar to those in text-fig. 32.

with *schillingsi*, and agrees with the type in all essential characters, except that the legs are distinctly spotted for some distance below the knees and hocks.

On the other hand, a mounted skin (text-fig. 32) in the Stuttgart Museum, brought by Mr. Schillings from Masailand, is assigned

Text-fig. 32.

Female Kilimanjaro Giraffe from Masailand; at Stuttgart.

by Dr. Matschie to *tippelskirchi*. With the exception, however, that the legs are more fully spotted below the knees and hocks, and the sides of the face are likewise more spotted, while the forehead may be darker, the specimen has all the characters of *schillingsi*, and in my opinion cannot be separated from that form.

Decisive evidence of the unity of the two forms is, however, afforded by the skin of the fore-legs and withers of a male from Kilimanjaro presented, at my suggestion, to the British Museum by Mr. Rowland Ward. In this skin, which has jagged and somewhat star-like chestnut spots of the character of those of the so-called *schillingsi*, the lower part of the fore-legs is fawn-coloured, and spotted almost or quite down to the hoofs, after the fashion of the type of *tippelskirchi*. In other words, we have a *tippelskirchi* from the typical *schillingsi* locality, which is, I think, sufficient to show that the two are identical.

Hitherto we have had no evidence as to whether the male of the present race has a third horn. That such an appendage was present is, I think, demonstrated by sketches of a Giraffe's head and skull, together with certain notes, made some years ago by Mr. Vaughan Kirby in Portuguese East Africa, for the opportunity of seeing which I am indebted to Mr. Ward.

These sketches show the head and neck of a male giraffe, having the type of coloration characteristic of the present form, and carrying a well-marked third horn on the forehead. At the same time this third horn appears to be decidedly smaller than in *G. c. rothschildi*; and I gather from Mr. Kirby's notes that some of the bull giraffes from the same locality have little or no third horn. This accordingly demonstrates that in Portuguese East Africa a Giraffe, closely allied to and probably identical with *G. c. tippelskirchi*, is tending towards the Cape type in the characters of the skull, as is the typical *tippelskirchi* in the coloration of the limbs.

I may add that Mr. Vaughan Kirby regarded his Giraffe as indicating an undescribed form.

That *G. c. rothschildi* grades into *tippelskirchi*, and the latter into the under-mentioned North-Transvaal form, is, I think, quite possible. It is somewhat curious that immediately south of the equator the Giraffes on the eastern side of Africa tend to become spotted and dark-coloured on the lower part of the limbs, and at the same time to lose the third horn of the bulls.

6. Congo Giraffe.

GIRAFFA CAMELOPARDALIS CONGOENSIS.

Giraffa camelopardalis congoensis Lydekker, Hutchinson's Animal Life, vol. ii. p. 83 (1903).

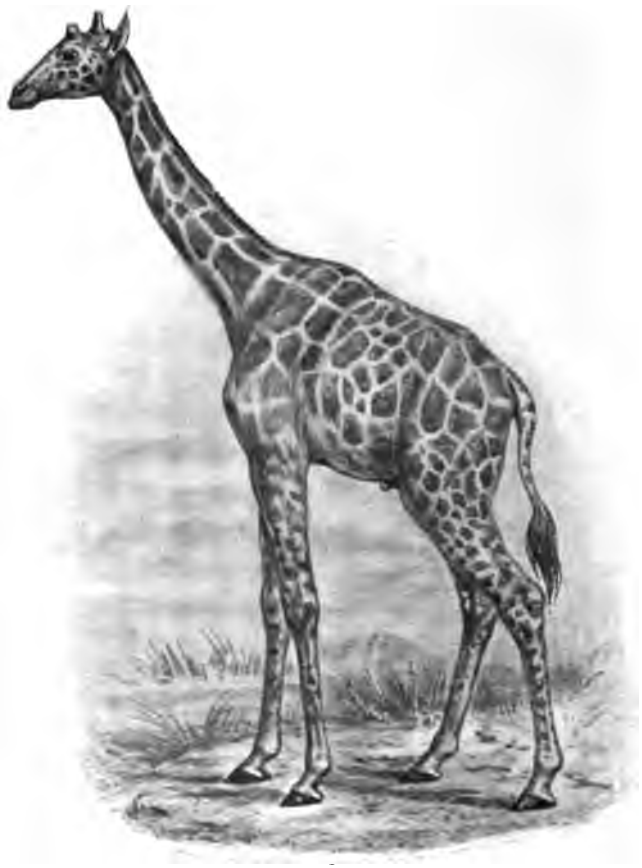
Hab. Katanga, Congo Free State.

A race typified by an adult mounted bull in the Congo Museum at Tervueren, near Brussels (text-fig. 33, p. 220).

Specially characterised by the well-developed frontal horn, coupled with the full spotting of the lower portion of the limbs (especially the hind pair), of which the ground-colour is grey-fawn, and the large size and subquadrangular form of the body-spots, which show no tendency to split up into stars.

From the presence of a well-developed frontal horn, this animal is clearly allied to the northern and eastern forms of the species. On the other hand, it resembles the South-African race (*G. camelopardalis capensis*) in having the hind-legs spotted right down to the hoofs; the fore-limbs also displaying the same feature, although

Text-fig. 33.



Male Congo Giraffe. (From the type specimen in the Tervueren Museum.)

less distinctly. The sides of the head are much more fully spotted than in the Cape form, and the tail is remarkable for the great fullness of its terminal tuft. In the spotting of the legs it resembles the description of the type specimen of *G. camelopardalis tippelskirchi*, although the dark markings show no trace of the

ragged and star-like form characteristic of that race. As to the possibility of the Congo Giraffe being identical with the imperfectly-known *G. camelopardalis peralta* of Nigeria, it may be remarked that the latter takes its name from the great length of the cannon-bones of the legs, which indicate a very tall animal. The Congo specimen, on the other hand, although apparently adult, is a comparatively small animal.

B. *Frontal horn rudimentary; limbs more or less fully spotted to the hoofs.*

7. Angola Giraffe.

Giraffa camelopardalis angolensis. (Plate XIV.)

Giraffa camelopardalis angolensis Lydekker, Hutchinson's Animal Life, vol. ii. p. 121 (1903).

Hab. Angola.

Typified by a mounted male in Mr. Rothschild's Museum, at Tring, from the Cunene River, 150 miles south-west of Humbe.

Markings more of the network type than in *G. c. capensis*. Spots on face confined to an area lying below a longitudinal line running beneath the eye to the angle of the mouth. A small and indistinct triangular area below the ear in which the ground-colour is white. Body-spots large, with ill-defined margins, and brown in colour; a sudden break into smaller spots about the middle of the thigh. Ground-colour white or whitish; legs fully spotted to the hoofs, with the ground-colour of their lower portion tawny. Frontal horn represented by a low tuberosity or swelling.

This race differs from the Cape form, as represented by the old bull formerly exhibited in the British Museum, by the lighter ground-colour, the more net-like type of coloration, the browner colour of the spots, and the greater degree to which the latter extend on to the sides of the face.

Whether posterior horns were developed, I have not been able to ascertain.

8. Northern Transvaal Giraffe.

Giraffa camelopardalis wardi, subsp. n. (Plate XV. fig. 2.)

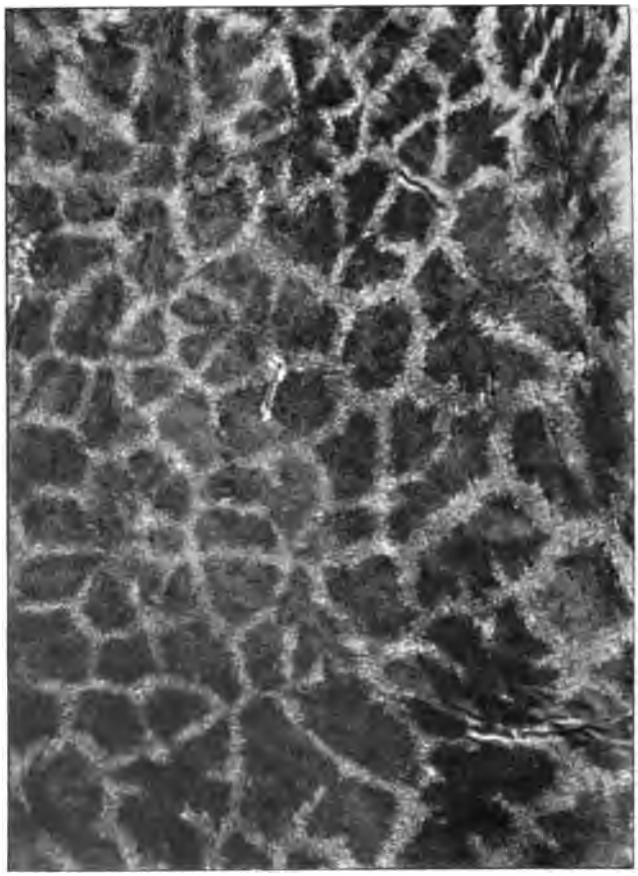
Hab. Northern Transvaal.

Typified by the body-skin of an adult bull presented by Mr. Rothschild to the British Museum, together with the skull and mounted head and neck of the same individual presented by Mr. Rowland Ward.

A large and dark chocolate-coloured Giraffe, with the frontal horn in old bulls represented by a low irregular boss, the posterior, or occipital, horns enormously developed, and the body-spots broken up into irregular stars, recalling those of *G. c. tippelskirchi*, from which, together with *G. schillingsi*, the present form (apart from the absence of a frontal horn) is broadly distinguished by the dark chocolate-brown, instead of chestnut, colour of the body-

spots. The stellate character of these spots widely distinguishes the race from the Cape Giraffe, between which and the East African forms of the *G. c. tippelskirchi* type it constitutes, however, a connecting link.

Text-fig. 34.



Portion of body-skin of North Transvaal Giraffe.

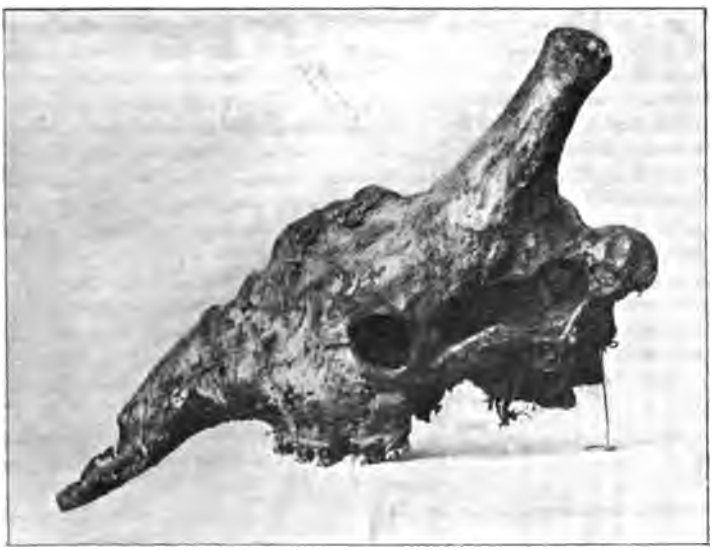
So far as I know, the habitat of this Giraffe is quite isolated.

The skull of the N. Transvaal Giraffe is remarkable for the extraordinary development of the posterior, or occipital horns, as is well shown in the accompanying photograph. These horns are very much larger than in the Baringo Giraffe; and in possessing these appendages the present race presents a marked contrast to

both the Lado and the Cape forms, in which they are wanting. The presence of posterior horns, coupled with the abortion of the front horn, is therefore a distinctive feature of the present form, which might appropriately be called the Four-horned Giraffe.

Entering somewhat more fully into the details of the features presented by the skull of this form, it may be mentioned that, in addition to the great size of the posterior, or occipital horns, it is characterised by its generally large dimensions, and more especially by the great length and massiveness of the main horns, of which the extremities are expanded in a knob-like manner. The length of the horns, measured from the surface of the skull between their bases, is 7 inches, against 5¼ inches in a male

Text-fig 35.



Skull of male North Transvaal Giraffe.

skull of the Baringo Giraffe collected by Sir H. Johnston. In a giraffe-skull from the Sudan in the British Museum the horns are, however, nearly as long as in the present specimen, but are much more slender. In the Transvaal skull the basal length is 25 inches, against 24¼ inches in the aforesaid specimen of the Baringo race. It is thus larger than most, if not all, giraffe-skulls from East Africa. On the other hand, it is exceeded in this respect by the type, and only known, female skull of the Nigerian *G. c. peralta*, of which the basal length is 26¼ inches. This affords an indication of the very large dimensions presumably attained by the last-named race.

The aborted frontal horn in the Transvaal skull (text-fig. 35. p. 223) forms an irregular nodular boss, measuring 6 inches in antero-posterior length. In front are two much smaller bosses placed one before the other in the median line. So far as I have seen, no other Giraffe possesses such a large frontal boss.

Of course other skulls are required in order to ascertain whether the large size of the posterior horns and of the frontal boss is constant, and not due to age. I think, however, it will turn out it is so; for although the present skull, as shown by the teeth, belonged to a somewhat older individual than the aforesaid skull of the Baringo race, the difference in this respect is comparatively slight, and quite insufficient to account for the wide diversity in the size of the posterior horns.

As already mentioned, the distinctive characteristics of the North Transvaal Giraffe were first revealed by the body-skin presented to the British Museum by Mr. Rothschild, who subsequently gave to that Museum a cast of the skull of the same individual. Still later, Mr. Rowland Ward presented the Museum with the mounted head and neck of this same bull, which afforded additional material to demonstrate the distinctness of the present race. I have accordingly much pleasure in naming the North Transvaal Giraffe after Mr. Ward; its title thus being *Giraffa camelopardalis wardi*. I have especial pleasure in doing this, since, in a letter to the 'Field,' Mr. Ward was the first to point out the distinctness of the Somali Giraffe.

The general colour and arrangement of the spots on the head and neck are much the same as on the body. Compared with the Cape Giraffe the spots are much more irregularly formed and star-like, there is more white in the neighbourhood of the ear, and the occipital horns, each of which is capped by a black patch, are very large, instead of inconspicuous.

In connection with this race, I may refer to a piece of giraffe-skin sent home by Sir Alfred Sharpe from the Loango River, in Northern Rhodesia, westward of Lake Nyasa, which was exhibited before the Society by Dr. Sclater* in 1899, and identified provisionally with *G. c. capensis*. Not having seen the specimen, I cannot attempt to determine the form to which it pertained, although I think it practically certain that the true Cape Giraffe does not range so far north.

9. Cape Giraffe.

Giraffa camelopardalis capensis. (Plate XVI.)

Camelopardalis capensis Lesson, Nouv. Tabl. Règ. Anim. p. 168 (1842).

Giraffa australis Rhoads, Pr. Ac. Philad. 1896, p. 518.

Hab. Cape Colony and some of the adjacent districts. Typical southern form probably extinct.

* P. Z. S. 1899, p. 985.

A large and very dark-coloured Giraffe, without posterior (occipital) horns (text-fig. 36), displaying the "blotched type" of coloration in the most pronounced form, with the two sexes alike as regards the pattern of the spots, but the old bulls much darker than the cows. As regards the distinctive features of the spots, or blotches, it may be observed that the large chocolate-brown, or almost black, body-spots of the old bulls are more or less quadrangular in shape, without showing any tendency to split up into stars, and form conspicuous dark blotches upon a tawny ground. This type of coloration is thus the very reverse of the one obtaining in the Nubian *G. c. typica*, and still more markedly in the Somali *G. reticulata*, which may be called the "netted type" and consists of a network of lines on a chestnut or liver-coloured ground. The legs are fully spotted and dark-coloured throughout, and the frontal horn is rudimentary.

Text-fig. 36.

Skull of male Cape Giraffe.

It appears, however, that the typical blotched coloration is displayed in its most characteristic form only in the Cape representatives of this race, which is probably now almost or quite exterminated. To this typical representative of the race belongs the old bull presented by Lord Derby to the British Museum and formerly exhibited to the public, but now relegated to the store series; it is from this specimen that Plate XVI. has been drawn.

In the head and neck of a somewhat younger, and therefore lighter-coloured, bull from the North Kalahari, presented to the Museum by Mr. Bryden, there is a decided tendency towards

the netted type; and this tendency is still more marked in the female Southern Giraffe now living in the Society's Gardens, which came from the Sabi River in Portuguese territory, considerably to the north of Cape Colony (*cf.* P. Z. S. 1895, p. 161). Compared with *G. c. capensis*, the light lines between the spots are much narrower and more sharply defined, while the spots themselves tend on the lower part of the hind-quarters to become serrated on the margin. The starring and splitting-up of the spots characteristic of the North Transvaal Giraffe are noticeable in the living animal. Unlike the typical form of the Cape race, the lower part of the legs is not completely spotted, the spots on the hind pair not extending to any great distance below the hocks.

Although this cannot be determined without comparison of the skulls, I think it probable that this Giraffe may belong to *G. c. wardi*.

The young male Giraffe from the Transvaal, probably near the borders of Portuguese East Africa, purchased by the Society in the spring of 1899*, also appears, according to the excellent photograph by Mr. Dando exhibited to the Meeting, to approach the type of *G. c. wardi*.

A coloured figure of the true Cape Giraffe is given in plate xi. of Sir Cornwallis Harris's 'Portraits of the Game and Wild Animals of South Africa,' which, judging from the other plates in the same work, may be considered a fairly correct, although perhaps somewhat too highly coloured, portrait of the animal. According to this picture, the ground-colour of the skin is bright orange-fawn (or almost flesh-colour), upon which are large widely separated blotches, with ill-defined borders and the centres markedly darker (deep chestnut) than the periphery. On the upper part of the limbs the spots tend to become somewhat irregular and jagged in outline, and they gradually decrease in size as the hoofs are approached. A white area is shown on the sides of the head and neck below the ear.

C. *Incertæ sedis.*

10. Nigerian Giraffe.

Giraffa camelopardalis peralta.

Giraffa camelopardalis peralta Thomas, Proc. Zool. Soc. London, 1898, p. 40.

Hab. Nigeria, in the neighbourhood of Lokoja, at the junction of the Niger and Benue rivers.

Since this form was described only on the evidence of the skull and limb-bones, it is at present impossible to assign it to its true position in the series. The limb-bones indicate an animal of great bodily height. The skull (text-fig. 37, p. 227), although

* See P. Z. S. 1899, p. 595.

unfortunately that of a female, apparently indicates a three-horned race.

Text-fig. 37.

Type female skull of Nigerian Giraffe.

EXPLANATION OF THE PLATES.

PLATE IX.

Giraffa camelopardalis typica, ♂, p. 205.

PLATE X.

G. c. typica, ♀, p. 205.

PLATE XI.

G. c. antiquorum, ♂, p. 205.

PLATE XII.

G. c. rothschildi, ♂, p. 210.

PLATE XIII.

G. c. rothschildi, ♀, p. 210.

PLATE XIV.

G. c. angolensis, ♂, p. 221.

PLATE XV.

Fig. 1. Head of *G. c. cottoni*, p. 207. Fig. 2. Head of *G. c. wardi*, p. 221.

PLATE XVI.

G. c. capensis, p. 224. From Lord Derby's specimen in the British Museum.

February 16, 1904.

HERBERT DRUCE, Esq., F.L.S., Vice-President, in the Chair.

The Secretary read the following report on the additions that had been made to the Society's Menagerie in January 1904:—

The registered additions to the Society's Menagerie during the month of January were 57 in number. Of these 26 were acquired by presentation and 4 by purchase, 1 was born in the Gardens, and 26 were received on deposit. The total number of departures during the same period, by death and removals, was 124.

Among the additions special attention may be called to the following:—

1. A fine specimen of the Hainan Gibbon (*Hylobates hainanus*), deposited on Jan. 25th.

2. A specimen of a Philippine Hornbill (*Penelopides affinis*), presented by Mrs. Johnstone on Jan. 26th, and new to the Collection.

The Secretary read the following letter addressed to Sir Harry Johnston, K.C.M.G., K.C.B., by the late Mr. W. G. Doggett, dated Anglo-German Boundary Commission, Uganda, November 3rd, 1903:—

"Since writing last I have collected more information as to the 'Okapi' from a 'Mububa' native of the Mboga country, who is travelling with our Sudanese escort. I am doing my best to get this man as a guide to his country, where he says the 'Okapi' is to be found in large herds. He also says that there is another large Antelope like the 'Okapi' which they call 'Shaw-le,' and which lives in the more open country. He goes on to say that the 'Okapi' found in 'Mboga' has horns about 18 inches long with two curves (only in males).

"So if I get a permit I shall certainly go and see what can be got there. I hope by the next mail I shall be able to send you a photograph of Lake 'Ruakatenge' and a few notes, for the African Society's Journal. It's within two hours of our present camp."

The Secretary remarked that since his journeys into this part of the Congo Forest (to the west of the Semliki River) Sir Harry Johnston was of opinion that the reports of the natives, made to himself, to Stanley, to Doggett, and to such other travellers as had recorded them, pointed to the existence, possibly, not only of the Okapi which has now been made known, but of two other mammalian types in this north-eastern fringe of the Congo Forest. If the reports about these other creatures are as well based as were those of the Okapi, they would indicate the existence in North-east Congoland of another large ruminant, possibly a Tragelaphine, and a large pig-like animal. He was informed by

Sir Harry Johnston that Doggett's 'Shaw-le' Antelope was also described to him by Balega people from the west of Lake Albert, and struck him from the description (if there is any fact at the bottom of these stories) as being very similar in appearance to a Nilghai. Sir Harry also thought that the large Forest 'Pig' of which Sir Henry Stanley had heard, and which was also mentioned to himself, might possibly be the Dwarf Hippopotamus which occurs in the forests of West Africa.

Prof. E. A. Minchin, F.Z.S., exhibited and made remarks upon a specimen of the Spider *Heteropoda regia* (Fabr.), which had been captured at University College, London. This Spider had a very wide distribution, which was probably due to its being carried by the wind during its younger stage and also by ships.

The following papers were read:—

1. Description of a new Antelope.

By Hon. W. Rothschild, D.Sc., F.Z.S.

[Received February 15, 1904.]

CEPHALOPHUS NYASÆ DEFRIESI.

This small buck is evidently a local representative of *C. nyasæ* (described by Mr. O. Thomas in the Ann. & Mag. Nat. Hist. ser. 7, vol. ix. p. 58), and is, like that form, at once distinguishable from all others of the *C. monticola*-group by the extreme length and attenuation of the skull, and the produced hoofs necessary from the marshy ground forming its habitat.

It differs from *C. nyasæ* in the greater extent of red on the flanks and thighs and more intensely rufous legs. The belly is much more extensively white, the greyish brown of the upper surface is paler, and the light streak on the side of the face and over the eye broader and more rufous.

Described from 2 ♂ and 1 ♀ procured by Mr. Louis de Fries, after whom it is named.

Hab Northern Rhodesia. 1 ♂ from Itambe, between Lakes Mweru and Tanganyika; 1 ♂, 1 ♀, Kafue River, near borders of Barotse-land.

Mr. de Fries gives me the following notes:—"This small Antelope is called Kampalanga by the Swahili and Walamba natives. It lives in the swamps in company with Situtunga (*Tragelaphus selousi*). Its food consists chiefly of the leaves of the rubber-vine, and I have never found examples weighing more than 9 lbs. When pursued these animals take refuge in the swamps and even deep water."

2. Another Contribution to the Knowledge of African Phytophagous Coleoptera. By MARTIN JACOBY, F.E.S.

[Received January 9, 1904.]

(Plate XVII.*)

The following descriptions are based on new species from different parts of Africa and contained in my collection, which were sent to me for identification by Mr. Cecil Barker of Malvern, Natal, the Rev. J. A. O'Neil of Cape Colony, Dr. Brauns of the same place, and Mr. Sheppard of Beira. The present paper deals with the first groups as far as the *Chrysomelinæ*; the rest of the Phytophaga will form the subject of another contribution.

CRIOCERINÆ.

LEMA WEISEI, sp. n.

Underside and antennæ and legs black, upperside dark brown; thorax with several rows of very fine punctures at middle of disc, otherwise impunctate; elytra with a sutural depression at the base, deeply punctate-striate, the interstices costate posteriorly.

Length 7 millim.

Head constricted behind the eyes, with two highly raised, deeply divided, and sparingly pubescent tubercles, dark brown, the anterior portion black; eyes large and prominent, deeply notched; antennæ not extending to the middle of the elytra, the third and fourth joints equal, terminal joints slightly thickened; thorax scarcely longer than broad, the sides not strongly constricted, with the usual deep fovea which gradually diminishes towards the disc, the base deeply transversely sulcate, the surface with three or four rows of fine punctures at the middle, anterior angles slightly tuberculiform; elytra with a more or less deep depression below the base near the suture, strongly punctate-striate, the first row of punctures double at the anterior portion, the interstices near the apex strongly costate and closely approached; below finely pubescent.

Hab. Lambarem, Fr. Congo (Coll. Belgian Mus. and my own).

This is another and no doubt quite distinct species belonging to the group of *L. armata* Lac., *L. hottentota* Lac., and *L. macrodera* Weise. The sculpturing of the thorax is quite different, inasmuch as there is scarcely any punctuation excepting the median rows, and these are very fine; there is also an entire absence of any transverse wrinkles, and the antennæ are much longer than in *L. cephalotes* Lac. I have received several specimens of this species from M. Clavareau.

LEMA CYANEOPLAGIATA Jac.

Var. Elytra metallic blue, the apex, in shape of a triangular spot, testaceous.

* For explanation of the Plate, see p. 270.

Hab. Salisbury, Mashonaland (*G. Marshall*).

The type of this species was described by me (Proc. Zool. Soc. 1898, p. 214) from a specimen which had the ground-colour of the elytra testaceous, the suture, a small humeral and a larger subapical spot metallic blue. Since then I have received two specimens from Mr. Marshall, which agree in every detail excepting the colour of the elytra as given above. This will probably prove to be the normal form; the rather flattened thorax and the black head spotted with fulvous are the principal characters which distinguish this species.

LEMA MALVERNENSIS, sp. n.

Reddish fulvous, the antennæ, apex of the tibiæ, and the tarsi black; thorax very closely punctured; elytra metallic blue, the extreme lateral margins and the apex fulvous.

Length 6 millim.

Head distinctly punctured, with highly raised, posteriorly divided tubercles, the labrum black; antennæ not very long, the basal joint fulvous below, the second and third very short, equal, the fifth and following joints of equal length, black; thorax not longer than broad, strongly constricted at the sides below the middle, the anterior angles rather pointed when seen from above, the basal sulcus very deep, connected with the lateral fovea, the surface closely and finely punctured, with two longitudinal shallow grooves placed at the anterior portion near the sides; scutellum fulvous; elytra with a small fovea below the base near the suture, closely and strongly punctured, the interstices but slightly raised near the apex, the latter fulvous to a small extent as well as the thickened lateral margins; underside fulvous, clothed with fine yellow pubescence; legs fulvous, the apex of the tibiæ and the tarsi black.

Hab. Malvern, Natal.

This *Lema* is evidently closely allied to *L. kolbei* Weise (Wiegm. Arch. 1901, p. 156), but, according to the description, the thorax of that species is longer than broad and devoid of the two longitudinal grooves, and the elytra are entirely blue.

LEMA GERSTAECKERI, sp. n.

Below, the head, antennæ, and legs black, above metallic dark blue; thorax nearly impunctate, deeply sulcate and bifoveolate anteriorly; elytra with a sutural depression, moderately strongly punctate-striate, the interstices at the sides and apex convex.

Length 5 millim.

Head bluish black, impunctate, with two highly raised elevations of elongate shape and divided by a deep groove, eyes deeply notched, clypeus finely punctured; antennæ about half the length of the body, black, the third and fourth joints equal, the eighth to the tenth joint twice as long as broad, terminal joint more elongate; thorax rather broader than long, the sides with a deep transverse fovea, bounded above by a longitudinal short ridge, immediately

followed by the deep transverse sulcus, anterior angles tuberculate, the sides from the middle to the tubercles obliquely diverging, the surface impunctate, with the exception of a few minute punctures at the middle of the disc, the latter with two foveæ, one at each side before the middle, and joined at the latter place by a feeble curved groove, only visible in certain positions; elytra subcylindrical, feebly depressed below the base near the suture, the shoulders rounded, the punctures closely placed and moderately strong, much finer towards the apex, the ninth row entire, interstices flat and impunctate except near the apex where they are raised; below and the legs black, finely pubescent.

Hab. Mashonaland (my collection).

This is another of the smaller-sized blue species, closely allied to *L. azurea* Lac., but differing in the curved antemedian depression of the thorax which ends in a fovea at each side; from *L. suahilorum* Weise, the absence of the deep elytral depression, the frontal tubercles of the head, and the larger size will separate the species. *L. acutangula* Weise has the antennæ and the tibiæ and tarsi more or less testaceous, also a punctured thorax, and *L. fugax* Weise has likewise a closely-punctured thorax and is of smaller general size.

LEMA GRAMINIS, sp. n.

Below, the head, antennæ and the tarsi black, above testaceous, antennæ short; thorax subcylindrical, scarcely constricted, impunctate; elytra closely punctate-striate; scutellum black.

Length 3½ millim.

Head flat, black, sparingly pubescent, the eyes prominent, entire; antennæ not extending to the middle of the elytra, the terminal joints widened, black, the lower four joints more or less fulvous; thorax subcylindrical, but slightly constricted near the base, with a very feeble transverse groove near the same place, preceded at the middle by a short longitudinal depression, impunctate, with the exception of some extremely minute punctures at the middle of the disc; scutellum black; elytra testaceous, with deep punctures placed in closely approached rows, the interstices near the apex costate; legs flavous, the breast, abdomen, and the tarsi black.

Hab. Salisbury, Mashonaland, on root of grass (*G. Marshall*).

This little species is of the same *Salpingus*-like shape as *L. brevicornis* Jac., but differs in the colour of the antennæ and in the black underside; the thorax above also is of more convex shape than in the allied species and the head is black.

LEMA NIGROFRONTALIS, sp. n.

Elongate and narrow, testaceous, the antennæ and a spot on the top of the head fuscous, the latter pubescent; thorax with a fovea at the sides, impunctate; elytra closely punctate-striate, the suture and a spot on the shoulder black; tarsi stained with fuscous; breast black.

Length 5 millim.

Var. Elytra entirely testaceous.

Head constricted behind the eyes, pale fulvous, the eyes large and round, the intermediate space as well as the anterior portion clothed with short golden pubescence, the middle of the vertex with a round blackish spot; antennæ short, fuscous, the base of the intermediate and following joints fulvous, the basal joint entirely of that colour; thorax not longer than broad, constricted near the base, the sides with a slightly-curved not deep groove and a deeper round fovea placed higher and anteriorly, the surface entirely impunctate, testaceous; scutellum black; elytra with deep round punctures placed in closely approached rows and of smaller size posteriorly, the shoulders not very prominent and bounded within by a black spot, the extreme sutural margin of the latter colour; legs testaceous, the apex of each joint of the tarsi fuscous; breast black, closely covered with golden pubescence; abdomen fulvous.

Hab. Salisbury, Mashonaland (*G. Marshall*).

A species of narrow shape, and distinguished by the colour of the head in connection with the pubescence of the latter. The variety agrees in every way with the type, except in the absence of the elytral black markings, which may perhaps vary to a greater or less extent in other specimens.

LEMA ÆTHIOPICA, sp. n. (Plate XVII. fig. 1.)

Reddish fulvous, the antennæ (the first joint excepted) and the tarsi black; thorax very closely and strongly punctured, deeply transversely sulcate and bifoveolate; elytra metallic blue, the apex fulvous, strongly punctured, the interstices transversely wrinkled.

Length 7 millim.

Head sparingly but distinctly punctured, strongly bituberculate, constricted behind the eyes, the latter deeply notched; clypeus extending upwards into a broad but anteriorly pointed prolongation between the antennæ; labrum black; antennæ comparatively short, slightly and gradually thickened towards the terminal joints, black, the basal joint fulvous; thorax not longer than broad, anteriorly widened, the angles tuberculiform, the lateral foveæ deep, bounded above by a perpendicular ridge, the basal sulcus very deep, the surface with a round fovea at each side anteriorly, extremely closely and rather strongly punctured throughout, the punctures of different sizes; scutellum fulvous; elytra convex, not depressed below the base, the punctures closely placed and strong, the interstices scarcely raised, transversely wrinkled, the apex to a short distance fulvous; below and the legs fulvous, the tarsi black.

Hab. Mashonaland (my collection).

A very distinct species of rather large size, well distinguished by the very closely punctured and bifoveolate thorax and the coloration of the elytra.

LEMA HUMERONOTATA, sp. n. (Plate XVII. fig. 2.)

Black; head and thorax dark æneous, closely punctured; elytra deeply punctate-striate, blackish æneous, the shoulders with a subquadrate fulvous spot; base of the tarsi and of the antennæ testaceous.

Length 3 millim.

Head with a deep longitudinal central groove, obscure æneous, finely punctured, eyes very large and subglobular; antennæ gradually thickened towards the apex, the second to the fifth joint gradually lengthened, terminal three joints shorter again, the base of each joint fulvous; thorax not longer than broad, the sides only slightly constricted near the base, obliquely widened towards the apex, anterior angles not prominent, the base with a shallow transverse sulcus, the surface finely and closely punctured; scutellum black; elytra with a deep depression below the base, strongly and closely punctate-striate, the ninth row of punctures entire, the interstices raised at the sides and apex, dark æneous, the shoulders with a subquadrate fulvous spot, extending inwards to the fourth row of punctures; tarsi slender, pale testaceous or fulvous, darker at the apex of each joint; anterior tibiæ obscure fulvous.

Hab. Malvern, Natal (*C. Barker*).

Of this pretty little *Lema* Mr. Barker sent a single specimen; its system of coloration and the shape of the thorax will distinguish it from every other except *L. pauli* Weise, with which I should have identified it but for the following differences. Weise describes the thorax of his species with a distinct transverse ridge in front of the basal stripe (I suppose by the latter is meant the sulcus); of this no trace can be found in the present species; the general shape of the thorax is not given nor the structure of the antennæ; the elytra are described as blue and the humeral spot as beginning very narrowly at the base; the opposite is the case in the species described here, where the humeral mark is of nearly equal width, except at the lateral margins, where it is slightly lengthened. In Weise's species the elytral depression is also described as obsolete; in the Malvern species it is deep.

LEMA ICTERICA Weise.

Three specimens obtained at Malvern, Natal, and kindly sent by Mr. Barker, I must, for the present, refer to this species (Archiv f. Naturgesch. 1901, p. 160), as the insect is evidently a most variable one. The structural characters and the sculpture agree very nearly with Weise's description, but not the coloration; in the type the clypeus and labrum are described as black. In the Malvern specimens these parts are flavous, all three varying in coloration as follows:—

No. 1. Flavous; antennæ black, the basal joint flavous; thorax with a greenish-black lateral stripe at each side; elytra with the greater portion of the disc dark æneous, only a basal spot and a narrow lateral stripe remaining flavous.

No. 2. The antennæ fulvous, joints 2 and 3 darker; elytra flavous, a sutural spot below the scutellum and the lateral margins dark æneous.

No. 3. Like No. 2, but each elytron with a small elongate spot below the scutellum.

In all the specimens the legs are flavous (not black or partly so as in Weise's specimens); the breast and abdomen are more or less piceous and finely pubescent.

As the typical specimens were obtained in the Transvaal, it is of course quite possible that the Malvern examples represent another allied species.

LEMA HIRTIPENNIS, sp. n.

Elongate, pubescent, dark violaceous, the antennæ and legs black; head rugose; thorax subquadrate, strongly and closely punctured, head and thorax pubescent; elytra closely and strongly punctate-striate, the interstices finely transversely wrinkled and clothed with grey stiff pubescence.

Length 7 millim.

Closely allied to *L. cœlestina* Klug, but differing in the following respects:—The eyes are much smaller and less prominent than in that species, the thorax is shorter, not longer than broad, and instead of being finely transversely wrinkled, is strongly and irregularly punctured, with a feebly-raised middle space or line; the sculpturing and the pubescence of the elytra are similar to those of *L. cœlestina*.

Hab. Mashonaland (a single specimen in my collection).

MEGALOPODINÆ.

MACROLOPHA Weise.

This genus, as well as *Sphondylia*, has been established, and rightly so, by Weise for the reception of several species formerly placed in *Pœcilomorpha* Hope, from which they principally differ in the shape of the thorax. So far as I know at present, the following species must likewise be placed in *Macrolopha*, viz.: *P. lacordairei* Westw., *P. murrayi* Baly, *P. centromaculata* Jac., and *P. mashonana* Jac.

CLYTHRINÆ.

MIOPRISTIS BRAUNSI, sp. n.

Metallic dark blue or greenish, finely pubescent; thorax strongly transverse, rugosely punctured, the anterior margin fulvous at each side; elytra finely transversely rugose, a basal spot, a narrow transverse band at the middle, another near the apex, and the lateral margins flavous.

Mas. Mandibles very prominent and curved, the anterior legs very elongate.

Fem. Mandibles normal, the thorax less transverse, anterior tarsi shorter.

Length 5 millim.

Elongate and parallel, clothed with very short grey pubescence, the head irregularly punctured with a rather deep central groove, metallic blue; eyes entire, round; antennæ slender, the first joint elongate, curved, the second moniliform, the third scarcely longer but thinner, the following four joints triangularly dentate, the rest of normal shape; thorax more than twice as broad as long, the sides widened and strongly rounded at the posterior angles, the entire disc closely rugose-punctate, the anterior margin with a narrow short transverse band at each side, posterior margin sinuate at each side; scutellum broad, punctured, with a feeble middle ridge; elytra rather narrower at the base than the thorax, finely transversely wrinkled throughout, subopaque, a round spot near the scutellum, a narrow transverse band (strongly constricted at the sides) at the middle, another one near the apex, and the lateral and apical margins flavous.

Hab. Willowmore, Cape Town (*Dr. H. Brauns*).

Of this pretty little species Dr. Brauns kindly sent me three specimens, one male and two females; the anterior tibiæ of the male are strongly curved and the tarsi very elongate.

MIOPRISTIS O'NEILI, sp. n. (Plate XVII. fig. 8.)

Black; thorax impunctate, fulvous, with two large black spots; elytra testaceous, finely punctate-striate, the sutural margins very narrowly and a broad longitudinal stripe at the sides black; legs flavous, marked with black.

Length 5 millim.

Head rugosely punctured between the eyes and pubescent; mandibles broad, robust, obscure flavous; antennæ black, the lower four joints fulvous, the first joint subquadrate, short, the second and third joints short, the fifth and following joints triangularly widened; thorax of equal width, strongly transverse, the sides strongly rounded, the disc with a triangular strongly-punctured depression at the middle of the anterior margin, fulvous, impunctate, the sides with a large subquadrate black spot, another small spot is placed at the middle of the posterior margin; scutellum narrow, raised; elytra subopaque, with fine irregular rows of punctures, obsolete near the apex, the shoulders with a broad longitudinal stripe not extending to the apex, the suture also very narrowly black, excepting at the base; the anterior femora strongly incrassate, black as well as the tibiæ, the apex of both slightly stained with fulvous; the rest of the legs pale flavous, the femora more or less, the apex of the tibiæ and the tarsi black.

Hab. Dunbrody, Cape Colony (*Rev. J. A. O'Neil*), on mimosa.

MIOPRISTIS (ATELECHIRA) ZAMBESIANA, sp. n.

Metallic green, the basal joints of the antennæ, the thorax, and the tibiæ and tarsi fulvous; thorax impunctate; elytra very closely punctured, fulvous, a subquadrate spot at the base and another near the apex metallic green.

Mas. The left mandible abruptly curved and ending in a long point.

Length 6 millim.

Head with three small foveæ, placed triangularly, metallic green, distinctly and subremotely punctured and sparingly clothed with short hairs, the anterior margin of the epistome feebly concave; labrum and palpi fulvous, mandibles metallic green at the base, the strongly curved apex fulvous; antennæ not extending to the base of the thorax, the lower four joints fulvous, the others black, the second and third joints very short, the fourth but slightly longer, the following joints transverse but feebly dentate; thorax strongly transverse, the anterior margin straight, the posterior angles rounded, the surface convex, impunctate, fulvous; scutellum black, pointed, obsoletely ridged; elytra closely, strongly, and somewhat rugosely punctured, fulvous, with an elongately subquadrate metallic green spot at the base, extending nearly to the middle but not quite to the suture, and another more transversely shaped spot near the apex, with its posterior margin concave, this spot does not extend to either margin; underside metallic green, closely covered with silvery pubescence, the femora likewise green and pubescent, the base of the anterior femora and the tibiæ and tarsi fulvous, the anterior tarsi elongate, the first joint longer than the second.

Hab. Zambesi (*Bradshaw*) (my collection).

This little species almost resembles *M. aulica* Lac., but is at once distinguished by the fulvous not metallic-green thorax, and by the position of the first elytral spot, which is placed close to the base instead of below it. I only know the male of this species.

MIOPRISTIS BREVITARSIS, sp. n.

Black, the thorax flavous, with two large black spots, coarsely punctured; elytra very closely punctured, testaceous, with three black spots near the lateral margins and another near the suture below the middle.

Mas. The anterior legs elongate, their tarsi rather short.

Length 5 millim.

Very closely allied to *M. subrugosa* Jac. and of exactly similar colour and pattern, but evidently a distinct species; the head finely rugose and pubescent, black, the antennæ with the second and third joints fulvous, the rest black; thorax with the sides very slightly widened and rounded near the base, punctured, and with two large black spots as in *M. subrugosa*; elytra very closely and irregularly punctured near the base, more regularly and less closely so near the apex, the sides with three black spots near the lateral margins, placed in a row, another spot is situated near the suture below the middle; legs black, the base of the intermediate and the posterior tibiæ testaceous.

Hab. Grahamstown, on mimosa (*Rev. J. A. O'Neil*).

The differences between this species and *M. subrugosa* are as

follows:—The entire head in the present insect is black instead of having the epistome flavous, the basal joint of the antennæ is likewise black, not fulvous; the thorax, instead of having the sides rounded and widened at the middle, has these portions nearly straight except near the base; the anterior legs are entirely black, and their tarsi have the joints distinctly shorter; lastly, the entire underside is black, without a testaceous abdomen. I received a single male specimen from the Rev. J. A. O'Neil.

TITUBŒA UMTALIENSIS, sp. n.

Black, the head pubescent; thorax very closely punctured, the anterior and part of the lateral margins flavous; elytra semiregularly punctured, pale fulvous, a transverse band before the middle, extending to the shoulders, another band below the middle and a spot near the apex black.

Mas. Anterior legs very elongate as well as the tarsi.

Length 10–11 millim.

Head finely rugose and pubescent, the anterior margin of the epistome straight; antennæ black, the lower four joints fulvous, the fourth joint triangularly dentate; thorax transverse, the sides nearly straight, the posterior angles rounded, the surface strongly punctured anteriorly, more closely and finely so near the base, with a longitudinal groove at the middle of the latter, the anterior margin flavous, in shape of a narrow band extending to the anterior portion of the sides, the median lobe of the basal margin broadly rounded and produced; scutellum black, the apex rounded; elytra rather closely and semiregularly punctured, the interstices obsoletely costate near the apex, the lateral lobes below the shoulders rather pronounced, the ground-colour flavous, the first black band placed before the middle and consisting of two elongate connected spots, of which one is placed at the shoulders, the other at the disc; the second band below the middle is of more regular shape, but also sinuate at the margins, another transverse spot is placed near the apex.

Hab. Umtali, Mashonaland (*G. Marshall*); also Zanzibar.

There are four or five very closely allied species of *Titubœa* known from Africa, and this one seems to differ from all of them; the very elongate anterior legs and tarsi place the present insect in *Titubœa*. It differs from *T. abyssinica* Lefèv. in having a much more transversely-shaped thorax and in the uninterrupted fulvous band of the latter, also in the entirely different sculpturing of the elytra and the shape of their black bands. *T. pubifrons* Jac. (sub *Camptolenes*) is a narrower insect, with fulvous mandibles and similarly coloured tibiæ, the thorax is much more finely and sparingly punctured, and the elytral bands are narrower and of more regular shape; *T. thoracica* Jac. has a differently shaped thorax with discoidal depressions on that part, the elytra have no apical spot, and the tibiæ are fulvous; lastly, *T. rugosa* Jac. differs in having a very closely punctured and almost entirely fulvous thorax, more closely and irregularly punctured elytra, and

isolated spots instead of bands. This species is also found in South Africa instead of in the interior, so far as is known at present. The penis is very peculiar, of robust shape, with a central ridge above, the apex broadly widened and divided into an upper and lower acute transverse ridge, the first-named tridentate, the lower ridge triangularly pointed at the middle, the sides likewise produced into a broad triangular downwardly directed tooth. The female has, as usual, normal anterior legs and is very strongly and closely punctured, but agrees in all other respects with the male.

TITUBŒA PARVULA, sp. n.

Black, the head and thorax nearly impunctate; elytra fulvous, with a broad black transverse band near the apex.

Mas. The anterior legs and tarsi very elongate, the elytra very obsoletely punctured in indistinct rows.

Fem. Anterior legs normal, the elytra shining, very closely punctured in irregular rows.

Length 5 millim.

Head impunctate and without pubescence, the anterior portion finely longitudinally strigose, the epistome narrowed in front, ending in two points; mandibles robust; antennæ black, the lower three joints fulvous, the basal joint black above; thorax short and transverse, black, shining, the sides straight, the posterior angles rounded, the disc with an oblique transverse depression anteriorly, impunctate; scutellum black, pointed; elytra opaque in the male, with very obsolete rows of fine punctures, fulvous, a transverse broad band near the apex, extending to either margin and narrowed at the suture, black; anterior legs very elongate, the first joint of their tarsi half the length of the tibia, apex of the latter not mucronate.

Hab. Zambesi.

A small species, quite unlike most of its allies in coloration, and with a smooth, shining, black thorax.

DAMIA STRIGATIPES, sp. n.

Testaceous; the head, antennæ (the basal joints excepted), the breast and abdomen black; thorax narrowly margined, impunctate; elytra very closely and distinctly punctured, anterior femora black above.

Var. Head fulvous.

Length 6 millim.

Head impunctate, black, the vertex with a fulvous spot at each side, transversely sulcate between the eyes; intraocular space rather deeply triangularly depressed, the anterior margin of the epistome deeply emarginate, labrum flavous; antennæ comparatively slender, black, the lower three joints flavous; thorax distinctly narrowed in front, the anterior margin concave, the sides with a narrow reflexed margin, posterior angles obtusely rounded, the surface impunctate, with an obsolete short transverse

depression near the basal lobe; scutellum broad, the apex carinate; elytra not very strongly convex, very closely punctured, the extreme apex nearly impunctate; underside black, finely pubescent; legs rather elongate, the first joint of the tarsi as long as the following two joints together, the anterior femora more or less streaked with black above.

Hab. Algoa Bay, Cape (*Dr. Brauns*).

Of the two, apparently female specimens, kindly sent by Dr. Brauns, one has the head black, the other fulvous; on account of the rather slender tarsi and shape of the thorax, *Damia* seems to be the most suitable genus for the reception of this species.

DAMIA TRIFASCIATA, sp. n. (Plate XVII. fig. 9.)

Flavous; head and thorax fulvous, nearly impunctate, the latter with a central black spot; elytra extremely finely punctured near the suture, flavous, with a narrow transverse band at the base, another at the middle, and a third near the apex, black.

Length 6 millim.

Head extremely finely punctured, with a rather deep central fovea, fulvous; anterior margin of the epistome subquadrately and deeply emarginate; eyes large, oblong; antennæ flavous, the fourth and following joints strongly transversely widened; thorax transverse, the sides but feebly depressed, rounded, anterior margin straight, basal lobe of the posterior margin very slightly produced; the disc impunctate with the exception of some punctures near the base, fulvous, with a rather large central black patch; scutellum fulvous, its apex truncate; elytra very minutely punctured in indistinct rows near the suture, the sides nearly impunctate, flavous, with three narrow transverse black bands, the first at the base, extending to the shoulders, the second at the middle, broader and nearly regular in shape, and the third, of somewhat oblique direction and constricted at the middle, near the apex, the lateral margins are likewise black and connect all the bands; underside pale fulvous, finely pubescent; legs flavous, robust, the anterior pair rather elongate in the male; tarsi broad, the first joint shorter than the following two together.

Hab. Beira, E. Africa (*A. Sheppard*).

I received three specimens of this distinct species from Mr. Sheppard; in the pattern and coloration it much resembles certain African species of *Monolepta*.

GYNANDROPHTHALMA SALISBURIENSIS, sp. n.

Subcylindrical, dark blue; sides of the breast closely pubescent; antennæ and tarsi black; head and thorax remotely punctured; elytra with a few punctures at the suture and the sides only.

Length 4 millim.

Head with three depressions between the eyes of rather irregular shape, the vertex impunctate; clypeus transverse, nearly impunctate, its anterior margin concave; antennæ nearly extending to the base of the thorax, black, the second joint obscure

fulvous, the fifth and following joints strongly transversely widened; thorax strongly transverse, slightly narrowed anteriorly, the posterior angles obtuse; the disc with an oblique depression on each side near the base, finely and sparingly punctured except within the depressions, where the punctures are stronger; scutellum triangular, the apex convex, subtruncate; elytra subcylindrical, only visibly punctured at the middle and near the suture; underside nearly black, the sides of the breast rather densely pubescent.

Hab. Salisbury, Mashonaland (*G. Marshall*).

Smaller than *G. placida* Lac., and of quite different sculpturing; also entirely dark violaceous-blue.

GYNANDROPHTHALMA SCUTELLATA Weise (Wiegm. Arch. 1902, p. 127).

I cannot separate this species from *G. bicolor* Jac. (Proc. Zool. Soc. 1898, p. 217), according to Weise's description. I have since received specimens from Mr. Barker, of Malvern, Natal, in which the basal third of the elytra is black and the remaining portions rufous. The species seems very variable in regard to coloration, and is probably identical with *G. basipennis* Lac.

GYNANDROPHTHALMA VARICOLOR, sp. n.

Head black with a fulvous band; thorax rufous, very minutely punctate; elytra finely punctate-striate, black, the extreme basal and lateral margin at the shoulders and an apical spot flavous; legs and abdomen fulvous; breast black.

Length 4 millim.

Head black, with a transverse fulvous band between the eyes, the vertex with a few punctures only, the lower portion rugose-punctate and sparingly pubescent, anterior margin of the epistome concave; antennæ short, entirely fulvous, the fifth and following joints strongly transversely widened; thorax of normal shape, the posterior angles obtusely rounded, the sides nearly straight, the disc extremely minutely punctured when seen under a strong lens; scutellum black, triangular; elytra subcylindrical and parallel, distinctly punctate-striate at the anterior portion, the punctures nearly obsolete below the middle, black, the extreme basal margin, the lateral margins at the shoulders, and the apex flavous; abdomen and legs fulvous; breast black.

Hab. Dunbrody, Cape Colony (*Rev. J. A. O'Neil*).

I received a single specimen of this species, which is probably subject to great colour-variation like so many of its allies, but is well distinguished by the distinct punctate-striate elytra. The insect was obtained on mimosa-plants.

GYNANDROPHTHALMA ELONGATA Jac.

The Rev. J. A. O'Neil has sent me several specimens of a *Gynandrophthalma* obtained at Dunbrody which I cannot separate from this species; in spite of the breast being black, I cannot find any.

structural differences whatever from the typical form from Sierra Leone, which varies enormously in size.

GYNANDROPHTHALMA HIRTIFRONS, sp. n.

Testaceous; the head pubescent with a transverse black band, terminal joints of the antennæ fuscous; thorax impunctate; elytra finely punctured in indistinct rows, the shoulders with an obscure fulvous spot; breast and abdomen black.

Length 4 millim.

Head broad, clothed with yellow pubescence, fulvous, with a broad transverse black band between the eyes, the latter very large; anterior margin of the epistome straight at the middle, the angles produced; antennæ dark fuscous, the lower two or three joints flavous, second and third very short, fifth and following joints transversely widened; thorax of even shape, slightly narrowed in front, the posterior angles rather rounded, the surface convex, testaceous, impunctate, with a rather deep depression at the basal margin at each side; elytra subcylindrical, slightly narrowed posteriorly, testaceous, with traces of punctures arranged in rows, when seen under a very strong lens, the humeral callus obscure fulvous; legs flavous; breast and abdomen black.

Hab. Dunbrody, Cape Colony (*Rev. J. A. O'Neil*), on mimosa. A single specimen.

This is a very distinct species on account of the colour and the pubescence of the head; it is possible, however, that specimens occur which have the elytra more or less marked with fulvous.

CRYPTOCEPHALINÆ.

CRYPTOCEPHALUS SHEPPARDI, sp. n. (Plate XVII. fig. 6.)

Fulvous; the breast and abdomen black; thorax extremely closely punctured; elytra short and broad, finely punctate-striate, the interstices finely transversely wrinkled, the suture very narrowly, a humeral and subapical spot dark blue, apical joints of antennæ black.

Length $3\frac{1}{2}$–4 millim.

Head closely punctured, light fulvous, labrum and palpi black; antennæ short, the lower five joints fulvous, the others black, thickened; thorax with feebly rounded sides, extremely closely punctured and minutely granulate, the extreme basal margin black; scutellum black, broad, foveolate at the base and impunctate; elytra short and broad, very convex, finely punctate-striate, the interstices flat, finely wrinkled and sparingly punctured, fulvous, the sutural margin slightly widened posteriorly and two elongate spots on each elytron dark blue; of the latter, one is placed on the shoulders and the other of more elongate shape below the middle, occupying the spaces between the fifth and seventh row of punctures; pygidium black, margined at the apex with fulvous; underside black; legs and prosternum fulvous, the latter subquadrate, the posterior angles pointed.

Hab. Beira, E. Africa (*A. Sheppard*).

Very closely allied to *C. sacchi* Jac. (Ann. Genoa Mus. xxxix. p. 523, 1899), but I think a distinct species; the system of coloration is exactly similar, but the present insect is larger, of more robust shape, the thorax is still more closely punctured, the spots and elytral suture are blue not black, and the pygidium is margined with fulvous; the claws are also more distinctly appendiculate, not simple; the posterior elytral spot is of more elongate shape and placed less closely to the suture than in *C. sacchi*. In my description of that species I have given the colour of the antennæ as fulvous, but I find that in one specimen the lower joints only are of this colour, as is the case in the present species.

CRYPTOCEPHALUS O'NEILI, sp. n. (Plate XVII. fig. 7.)

Head black at the vertex; the lower portion, the basal joints of the antennæ, and the abdomen and legs fulvous; thorax flavous, with two broad black bands, impunctate; elytra finely punctate-striate, black, each with five flavous spots (1 . 2 . 2 . 1).

Length 5 millim.

Vertex of the head black, in shape of a transverse band, remotely punctured, the lower portion fulvous, eyes broadly emarginate; antennæ slender and filiform, the lower five joints fulvous, the rest black, basal joints gradually lengthened; thorax greatly narrowed anteriorly, the sides feebly rounded, the surface entirely impunctate, flavous, this colour confined to the sides, the anterior margin, and a central narrow band, the rest, in shape of two broad longitudinal bands not extending to the anterior margin, black; scutellum black, broad, its apex pointed; elytra with rather fine rows of punctures, the latter not very closely placed, the interstices, with the exception of the outer two, flat, the latter slightly convex, each elytron with five fulvous spots, divided by black bands and placed as follows—a narrow elongate spot at the base of the lateral margin, a large obliquely-shaped one from the middle of the base to the suture, two spots placed transversely immediately below the middle, and a fifth at the apex of somewhat transverse shape; pygidium, underside, and legs fulvous, the sides of the breast black.

Hab. Dunbrody, Cape Colony (*Rev. J. A. O'Neil*), on *Euphorbiæ*.

This *Cryptocephalus* closely resembles the European *C. 6-pustulatus* Rossi, and also *C. pustulatus* Fab. from Africa, but the number and position of the spots are different, also their shape and the pattern of the thorax differ.

CRYPTOCEPHALUS SUBCONNECTENS, sp. n. (Plate XVII. fig. 3.)

Fulvous, the vertex of the head and the underside black; thorax impunctate, with two black bands; elytra flavous, the suture, a humeral spot and another one near the apex, partly connected with the suture, black, punctuation strong and regular.

Length 5–5½ millim.

Head entirely impunctate and without depressions, the vertex

black, the entire lower portion, in shape of a large subquadrate patch, fulvous, eyes triangularly emarginate, labrum and palpi fulvous; antennæ short, black, the lower four joints fulvous, the terminal ones short; thorax subcylindrical, narrowed at the sides, the surface entirely impunctate, fulvous, with two longitudinal black bands, widely separated and not extending to the anterior margin; scutellum flavous, raised posteriorly, impunctate; elytra very strongly and closely punctate-striate, the interstices transversely wrinkled, the punctures distinct to the apex, flavous, a narrow sutural band, slightly widened at each end and not extending to the apex, and two spots on each elytron, black, the anterior spot placed on the humeral callus, the posterior one, near the apex, of more elongate shape and sometimes connected with the sutural band at its wider portion; pygidium closely punctured and pubescent, black, margined broadly with flavous; breast and abdomen partly black, the first segment flavous at the middle; femora black above, flavous below; tibiæ flavous at the base only, otherwise black as well as the tarsi; prosternum strongly narrowed anteriorly, the base straight.

Hab. Salisbury, Lesapi River, Mashonaland (*G. Marshall*).

Larger than *C. africanus* Jac. (=*unicinctus* Jac.), the thorax much longer, without the lateral small spots, and with a sutural band, the pygidium differently coloured and the elytral spots placed differently.

CRYPTOCEPHALUS SOBRINUS, sp. n.

Pale fulvous, the elytra testaceous, the terminal joints of the antennæ black; head closely punctured; thorax impunctate; elytra very closely and deeply punctate-striate, the interstices longitudinally costate.

Length 4 millim.

Head very closely and strongly punctured, pale fulvous; antennæ black, the lower five joints fulvous, terminal joints widened but much longer than broad; thorax of normal shape, entirely impunctate, fulvous, the extreme basal margin black; scutellum slightly elongate, dark fulvous; elytra slightly narrowed posteriorly, diverging at the apex, the latter separately rounded, the punctuation deep and strong, the punctures and the rows very closely placed, the interstices longitudinally costate; below and the legs fulvous, the latter robust, the breast and abdomen sparingly and finely punctured, the prosternum longer than broad, the posterior angles produced into a point.

Hab. Salisbury, Mashonaland (*G. Marshall*).

Amongst the unicolorous African *Cryptocephali* the present species may be known by the strong and closely punctured elytra and their costate interstices; the punctures are for the most part transverse in shape and partly confluent at the sides.

CRYPTOCEPHALUS BEIRAENSIS, sp. n. (Plate XVII. fig. 5.)

Flavous; thorax reddish fulvous, the sides and a central spot

flavous, the disc with two black bands; elytra finely punctate-striate, an oblique band from the shoulders to the suture and the apex dark brown, margined with black at the sides and apex.

Length 4 millim.

Head strongly punctured and sparingly pubescent, with a dark reddish triangular spot; antennæ short, only extending to the base of the thorax, fulvous, the terminal six joints slightly widened; thorax not very widened at the middle, the sides rounded, the surface very finely punctured, flavous, the anterior middle portion reddish fulvous, the sides with a short black curved band not extending to the anterior margin, these bands separate the flavous portion into three parts, two lateral spots and one medial spot at the base; scutellum flavous; elytra with rather fine rows of punctures, the interstices flat, the flavous ground-colour is confined to a transverse band surrounding the scutellum and a large transverse patch near the apex of each elytron, an oblique dark brown band from the shoulder to the middle of the suture and the similarly coloured apex limit the flavous portion, the dark bands are also margined with black, which at the sides forms a short longitudinal stripe, leaving the extreme lateral margin, however, of the flavous ground-colour as far as the middle; the pygidium and underside are fulvous, the prosternum is subquadrate, with its posterior margin furnished with two short acute points.

Hab. Beira, E. Africa (*A. Sheppard*).

A rather curiously marked species of which I received three specimens from Mr. Sheppard; it is somewhat allied to *C. comoedus* Suffr., but the shape of the elytral bands and their colour are quite different.

CRYPTOCEPHALUS CAPENSIS, sp. n.

Black, with greenish or bluish gloss; thorax impunctate; elytra moderately strongly punctate-striate, flavous, with two deeply dentate transverse bands, the second including a flavous spot, and the suture at the middle black.

Length 5 millim.

Head with some irregular depression and an obsolete central groove, sparingly punctured, blackish blue; antennæ slender, entirely black; thorax rather short, the sides nearly straight, the surface impunctate, coloured like the head; scutellum blackish blue, the apex bluntly rounded; elytra finely punctate-striate near the suture, more strongly punctured at the sides, the interstices flat, flavous, with a transverse black band before and another behind the middle, these bands are strongly dentate and connected at the suture and at the outer portion so as to include a round flavous spot at the middle near the suture; underside and legs bluish black.

Hab. Cape of Good Hope (my collection).

Somewhat similarly marked to *C. polyospilus* Suffr. and allied species, but from these and from the other banded African forms

this species is distinguished by the entirely bluish-black head and thorax, underside, and legs. I possess two exactly similar specimens, but have never seen any others from the Cape or other parts of Africa. My specimens were obtained as long ago as 1874.

CRYPTOCEPHALUS SEMIREGULARIS, sp. n.

Fulvous, the breast and abdomen partly black, pubescent; thorax impunctate, with two black spots; elytra irregularly punctate-striate, the interstices partly punctured, each elytron with 5 black spots (1 . 2 . 2).

Length 7 millim.

Head closely punctured, fulvous, the vertex with a black spot, eyes broadly emarginate; antennæ slender, black, the lower five joints fulvous, third and fourth joints equal, smaller than the fifth; thorax about one half broader than long, with an obsolete oblique depression at each side near the base, the surface impunctate for the greater part, a few minute punctures only are visible near the base, the sides with a somewhat transversely-shaped black spot; scutellum rounded at the apex, blackish; elytra with irregularly placed punctures arranged in rows which are often doubled, the interstices with smaller punctures placed here and there; of the spots, one is placed on the shoulders, the others transversely, of these, the first two are situated before the middle, the outer one rather lower than the other, the fourth and fifth spot below the middle are in the same line, one near the lateral, the other near the sutural margin; the pygidium, the legs, and the last abdominal segment are fulvous, the rest of the underside is black, clothed with short grey pubescence.

Hab. Dar-es-Salaam, E. Africa.

The position and number of the elytral spots is the same as in *C.* 16-*punctatus* Suffr., but the thorax has only two spots and the punctuation of the elytra is quite different. *C.* 5-*plagiatus* Jac. is of very nearly similar coloration and elytral markings, but is double the size, and flavous in colour above; the thorax has two black bands, and the elytral punctuation is more regular and stronger; the prosternum is also black, not fulvous.

CRYPTOCEPHALUS SEXPLAGIATUS, sp. n. (Plate XVII. fig. 4.)

Black, the head greenish, rugose-punctate; thorax reddish fulvous with two large black spots, sparingly and finely punctured; elytra finely punctate-striate, the interstices finely wrinkled at the sides, an elongate spot at the sides, a large oval spot below the scutellum, and the apex bright flavous.

Length 3 millim.

Head greenish black, closely rugose; antennæ black, the lower four or five joints fulvous, the basal one black above, the terminal three joints widened; thorax distinctly narrowed anteriorly, with a few very fine punctures near the base, reddish fulvous, the basal margin very narrowly black, the disc with a large irregular shaped black spot on each side; scutellum black; elytra black, rather

strongly punctate-striate anteriorly, much more finely so posteriorly, the interstices with a few fine punctures and very finely wrinkled at the sides, the humeral callus not prominent, each elytron with three bright flavous spots, an elongate one at the sides from the shoulders to the middle, a large oval spot opposite the first near the suture and below the scutellum between the first and sixth row of punctures, and the third spot near the apex, of slightly transverse shape; underside and the legs black, the tibiæ and tarsi more or less fulvous; prosternum subquadrate, the base straight, the surface with an obsolete longitudinal ridge.

Hab. Salisbury, Mashonaland (*G. Marshall*).

Not unlike *C. mirabilis* Suffr., but the head green and rugose, the elytra with three not four yellow spots, and the legs partly black.

CRYPTOCEPHALUS FLAVOFRONTALIS, sp. n.

Black; the head, the anterior and lateral margins of the thorax flavous, the latter impunctate; elytra finely punctate-striate, the interstices flat, black, each elytron with four flavous spots (1 . 2 . 1); the legs fulvous.

Length 4 millim.

Allied in the markings of the thorax and elytra to *C. gemmatus* Suffr., but deep black, not blue; the head entirely flavous, with a short central longitudinal groove at the vertex sparingly but distinctly punctured; antennæ long and slender, black, the lower six joints fulvous, the second to the fifth joint gradually lengthened, terminal joints elongate; thorax strongly narrowed anteriorly, the sides rounded, the surface very convex, black, very shining and impunctate, the anterior margin broadly, the lateral ones very narrowly flavous; scutellum broadly trigonate, black, impunctate; elytra with fine and regular rows of punctures, the interstices flat and with a row of very minute punctures here and there, the punctures near the base and the sides stronger than the posterior ones, each elytron with a transverse flavous spot at the base, an elongate, medially constricted one at the sides, extending to the middle downwards, a round spot near the suture and a transverse one at the apex; pygidium and underside black, the upper margin of the breast flavous; legs robust, fulvous; prosternum broad, the sides raised, the base slightly emarginate.

Hab. South Africa.

The only specimen contained in my collection without precise locality is apparently a male, and is somewhat similarly marked to *C. mashonanus* Jac., but that species has much shorter and robust antennæ, no flavous thoracic margins, and the elytral spots are of different shape.

CRYPTOCEPHALUS MANDIBULARIS Suffr.

I am almost certain that this form is only a colour-variety of *C. polyhistor* Suffr. (*Achænops mandibularis* Jac.). I have received both species, taken *in coitu*, from Mr. C. Barker of Natal, and

the female I cannot separate from that of *C. polyhistor* as described by Suffrian. The female of *C. mandibularis* was not known to Suffrian, who suspected it to be of similar coloration to his *C. polyhistor*, a surmise in which he was perfectly right; this sex has a fulvous thorax with an angulate black band and black elytra, the legs being fulvous. The only differences which Suffrian mentions between the two species are the more narrow shape of *C. mandibularis*, the differently marked elytra, and the legs which are partly black in the male. I am, however, almost sure that *C. polyhistor* is only the dark and spotted form, and the other species the paler one in which the elytral spots are reduced to two at the sides; traces of the other markings can be seen in some specimens; and, as I said above, the female cannot be separated from that of *C. polyhistor*. The name *Achænops mandibularis* must be omitted altogether on account of a mistake on my part.

ISNUS SUTURALIS, sp. n.

Black, basal joints of the antennæ and legs flavous; thorax closely and strongly punctured; elytra very closely punctate-striate, flavous, with a broad, sutural, posteriorly pointed black band, extending to below the middle.

Length 1½ millim.

Head piceous or black, remotely punctured, the labrum fulvous, eyes but slightly notched, not very closely approached; antennæ very short, the last six joints broadly widened, black, the lower four or five joints flavous; thorax obliquely narrowed in front, the basal margin pointed at the middle, the disc closely, evenly, and comparatively strongly punctured, black; scutellum narrowly elongate, black; elytra short and broad, distinctly punctured in very closely approached rows, the punctures stronger near the suture than at the sides, the outer two interstices broad and slightly convex, finely punctured, the outer portion flavous, the rest occupied by a broad blackish band which extends to the shoulders at the base and gradually narrows at the suture, where it ends in a point below the middle; pygidium piceous, strongly punctured; underside nearly black, the prosternum scarcely longer than broad, flattened, its base truncate; legs flavous.

Hab. Malvern, Natal (*C. Barker*).

This very small species agrees in all structural details with Weise's genus *Isnus* (Arch. f. Naturgesch. 1898, p. 216); it may be at once known by its coloration.

CŒNOBIUS MELANOCEPHALUS, sp. n.

Pale fulvous, the head black; thorax impunctate, the sides with a transverse depression; elytra strongly punctate-striate, the interstices convex, the apex black; below and the legs fulvous, the abdomen black.

Length 2½–3 millim.

Head black, the lower portion strongly punctured, the upper

part entirely occupied by the eyes; labrum flavous; antennæ with the last six joints thickened, black, the basal joints flavous; thorax narrowed in front, the sides nearly straight, the anterior margin accompanied by a deep transverse groove, the sides with another very obsolete transverse oblique groove, the entire surface impunctate, very shining, fulvous, the base produced into a short point at the middle; scutellum narrowly elongate; elytra strongly and closely punctate-striate, the seventh row interrupted below the shoulders, the interstices longitudinally convex, light fulvous, the extreme apex of each black; pygidium closely punctured, black; underside fulvous, the last four abdominal segments black, closely punctured; prosternum subquadrate, remotely punctured, fulvous, the posterior margin concave.

Hab. Salisbury, Mashonaland (*G. Marshall*).

Whether a rather larger sized specimen sent by Mr. Marshall, having the elytra finely punctured, the interstices broad and flat, and the entire apex black, also the pygidium and underside fulvous, represents the female of this species or is specifically distinct, I am unable to say at present.

ACHÆNOPS O'NEILI, sp. n.

Underside more or less black; head and thorax pale fulvous, the margins of the latter and two spots at the base yellowish white; elytra pale yellow, extremely finely punctured, the suture, a small humeral spot, and a more or less developed sutural spot or band near the apex black; antennæ and legs fulvous.

Length 2 millim.

Head impunctate, flavous, sometimes with a small central fulvous spot; eyes widely separated, not very deeply emarginate; antennæ short, pale flavous or fulvous, the terminal six joints widened; thorax narrowed in front, short, the sides nearly straight, the surface impunctate, fulvous, the lateral margins rather broadly, the anterior margins more narrowly, and a transverse band at the base pale yellow (the basal band is divided by an extremely narrow fulvous stripe); scutellum short, triangular, testaceous, margined with black; elytra with obsolete and fine punctures arranged in rows, yellowish white, the basal margin and the suture, a small spot on the shoulders, and a transverse band near the apex black, the band sometimes only indicated by a spot; underside black, the abdomen more or less and the legs pale fulvous; prosternum longer than broad, the base concave, the angles produced.

Hab. Dunbrody, Cape Colony (*Rev. J. A. O'Neil*).

Of this pretty little species I have received three specimens from the Rev. J. A. O'Neil, who states that they were obtained on mimosa-plants.

EUMOLPINÆ.

EURYDEMUS NIGRICEPS, sp. n.

Black; above and the basal joints of the antennæ fulvous;

thorax strongly and irregularly punctured; elytra deeply punctate-striate, the interstices longitudinally costate.

Length 6 millim.

Head remotely but strongly punctured, the clypeus distinctly separated, punctured; eyes large, oblong, rather closely approached; antennæ long and slender, black, the lower three joints fulvous; thorax rather long, distinctly narrowed anteriorly, the lateral margins subangulate near the base, nearly straight anteriorly, the disc strongly and irregularly punctured, with a narrow smooth central space; scutellum longitudinally depressed; elytra wider at the base than the thorax, very strongly and closely punctate-striate, the punctures transverse in shape, the interstices strongly longitudinally costate, eighth and ninth row of punctures abbreviated and joined before and below the middle; underside and legs black; femora with a small tooth.

Hab. Benito, Fr. Congo.

Allied to *E. holubi* Jac., but with differently coloured antennæ and legs and a strongly punctured thorax.

EURYDEMUS QUADRIMACULATUS, sp. n.

Fulvous; thorax strongly punctured; elytra deeply punctate-striate, the interstices longitudinally costate, the fourth interspace with a black spot before and another below the middle; femora dentate.

Length 5½ millim.

Head closely punctured, the epistome well separated, transverse, closely punctured; eyes large, closely approached; antennæ entirely fulvous; thorax but slightly broader than long, narrowed anteriorly, the disc strongly and rather closely punctured (in one specimen much more finely so); elytra with a distinct basal depression, sculptured as in *E. nigriceps*, immediately below the depression a small black spot is placed and another below the middle, all the femora with a small tooth.

Hab. Zambesi.

Of this species I possess two apparently female specimens; it is evidently closely allied to *E. raffrayi* Lef. in coloration, as there are likewise two small black elytral spots in that species; but Lefèvre describes the thorax as "much broader than long," which is certainly not the case in the present insect, and says nothing about the sculpturing of the thorax, nor does he mention any elytral costæ.

EURYDEMUS GENICULATUS, sp. n. (Plate XVII. fig. 11.)

Above pale fulvous; thorax closely punctured, with two large black spots; elytra strongly punctate-striate, the suture and a discoidal stripe, abbreviated posteriorly, black; knees, base of tibiæ and tarsi, as well as underside black.

Length 5 millim.

Head coarsely punctured, with a central narrow ridge; clypeus very closely rugose-punctate, intraocular space narrow; eyes very

large; antennæ long and slender, flavous, the seventh joint generally piceous; thorax scarcely one half broader than long, slightly narrowed anteriorly, the sides feebly rounded, anterior angles slightly produced outwards, the disc rather closely and strongly punctured, fulvous, with two longitudinal large black patches; scutellum impunctate; elytra scarcely perceptibly depressed below the base, strongly punctate-striate, the punctures distinct to the apex, the suture narrowly and a broader discoidal stripe, occupying the third to the sixth row, black, this stripe is abbreviated at some distance from the apex; femora robust, armed with a strong tooth.

Hab. Beira, E. Africa (*A. Sheppard*).

Evidently closely allied to *E. nubiensis* Har. and of nearly similar coloration, but the underside black, the elytra without black margins, the thorax equally strongly punctured. In some specimens the discoidal stripe is separated anteriorly into two spots or only indicated; these specimens are very pale in coloration and probably immature. *E. semivittatus* Jac. has a greenish and very closely and finely punctured thorax and entirely fulvous legs. *E. vittatus* Gestro has differently coloured antennæ, an unspotted thorax and black legs, the base of the femora rufous.

MENIUS BREVICORNIS, sp. n. (Plate XVII. fig. 11.)

Dark fulvous; the apical joints of the antennæ black, the latter short; thorax transverse, rather remotely punctured; elytra oblong, strongly punctate-striate, the interstices more or less convex; femora dentate.

Length 4 millim.

Head very sparingly and finely punctured, with a short central groove, eyes surrounded by a deep sulcus, clypeus separated from the face by a shallow groove, palpi flavous; antennæ short, the lower seven joints flavous, the rest black, the second joint as long as but thicker than the third joint, terminal joints slightly thickened; thorax nearly twice as broad as long, of equal width, the sides rounded, the angles acute, the disc convex, strongly and remotely punctured; scutellum smooth; elytra oblong, subcylindrical, deeply punctate-striate, the interstices longitudinally convex; femora dentate; prosternum broad, without sulcus.

Hab. Beira, E. Africa.

Of more oblong shape than is the case with most other species of the genus; the thorax not narrowed or deflexed anteriorly to any extent, and the antennæ shorter than usual.

SYAGRUS FULVIMANUS, sp. n.

Subcylindrical, dark greenish æneous; the basal joints of the antennæ, the knees, tibiæ, and the tarsi (partly) fulvous; head remotely, thorax finely punctured; elytra very strongly punctate-striate, the interstices at the sides costate.

Length 4 millim.

Head strongly and remotely punctured, with a short central

longitudinal groove; clypeus not separated from the face, punctured like the head; antennæ black, the lower three joints fulvous, second joint as long as the third, terminal joints thickened; thorax about one-half broader than long, the sides strongly rounded and deflexed anteriorly, the surface more finely and irregularly punctured than the head, the sides nearly impunctate; elytra with deep and strong rows of punctures, the interstices at the sides longitudinally convex; underside metallic green, impunctate; femora with a small tooth, the knees, tibiæ, and the tarsi fulvous, the last partly stained with piceous.

Hab. Zambesi (my collection).

Of this species I possess three specimens, one of which is probably a male; in this sex the clypeus is feebly separated from the face, more closely punctured and broader and the femoral teeth are more pronounced, otherwise there is no difference of importance. I cannot identify the insect with *S. rufipes* Weise (Deutsche ent. Zeit. 1883, p. 355), since the author describes his species as "short and ovate" and the thorax as strongly punctured; it belongs probably to *Menius* Chap. *S. minutus* Jac. is much smaller and has a strongly rugosely punctured thorax.

SYAGRUS TRISTIS, sp. n.

Elongate, subcylindrical, piceous; head closely rugose-punctate; thorax opaque, densely punctured, the sides finely serrate; elytra deeply punctate-striate, the interstices at the sides strongly costate; femora strongly dentate.

Length 4 millim.

Head strongly rugose throughout, the vertex strigose, opaque, eyes surrounded by a very narrow sulcus; antennæ piceous or dark fulvous, rather long and robust, the second joint distinctly shorter than the third; thorax one-half broader than long, moderately convex, slightly narrowed at the base, the lateral margins feebly rounded and finely serrate, the surface crowded with shallow round punctures, opaque, of leathery appearance; scutellum subpentagonal, smooth; elytra subcylindrical, wider at the base than the thorax, slightly depressed below the base, piceous or nearly black, shining, very deeply and closely punctate-striate, the punctures mostly transverse in shape, the interstices at the sides strongly longitudinally costate; underside piceous, impunctate; legs robust, femora strongly dentate; prosternum longer than broad, strongly rugose.

Hab. Beira, E. Africa; also Malvern, Natal (*C. Barker*).

Whether this species is distinct or not from *S. opaca* Jac. is somewhat doubtful; at any rate it is very closely allied; but the thorax in *S. tristis* is more closely and strongly punctured, and the same is the case with the elytra, which in *S. opaca* have the punctures shallow and nearly obliterated towards the apex; in the present species they are more shining, the punctures are deep and large and scarcely finer posteriorly; but these seem to be the only differences. Of each species I have three and four

specimens before me and no intermediate forms. *S. rugiceps* Lef. is described as having the head and thorax confluently rugose-punctate; in the present species these parts are very closely impressed with round, shallow punctures.

SYAGRUS INSIGNITUS Jac. (sub *Rhembastus*).

This species, described by me in the Ann. & Mag. Nat. Hist. 1898, vol. i. p. 353, must find its place in *Syagrus* as at present understood; it is closely allied to *S. alluaudi* Lefèv., but in that species the head and the clypeus are entirely impunctate, the elytra have a deep basal depression and their interstices are rather convex. Typical specimens named by Lefèvre are in my collection. *L. insignitus* seems, however, a rather variable species, of which the type was probably a unicolorous form. In other specimens which I have received since from the Transvaal the thorax has a central black mark, the elytra have the suture black at the base and a central spot near the middle of each; in structural characters I cannot find any differences.

NODOSTOMA CAMERUNENSE, sp. n.

Black or fulvous; the thorax very strongly and remotely punctured, subangulate at the sides; elytra deeply punctate-striate anteriorly, the punctures diminishing towards the apex; legs fulvous.

Length 2 millim.

Head remotely but distinctly punctured, the clypeus obsoletely separated; antennæ rather slender, piceous, the basal joints more or less flavous; thorax scarcely one-half broader than long, the sides angulate below the middle, the surface very strongly and remotely punctured, black; elytra with a distinct transverse depression below the base, deeply and strongly punctate-striate, the punctures diminishing in size posteriorly, the rows widely separated and the interstices flat, piceous, the base more or less fulvous; femora with a minute tooth, the intermediate and posterior tibiæ emarginate at the apex, claws appendiculate; prosternum broad, only slightly narrowed between the coxæ, strongly punctured.

Hab. Cameroons (my collection).

This is the first species of the genus from Africa and entirely typical. Weise has described another closely allied African genus *Aphthonestis*, but states that the prosternum is greatly narrowed, which is not the case in the present species. The two specimens before me differ greatly in coloration, one being nearly black, stained with fulvous on the elytra, and the other entirely of the latter colour. The angulate thorax and the strong punctuation will assist in the recognition of the species.

PSEUDIVONGIUS APICICORNIS, sp. n.

Nearly black below, above dark metallic blue; the basal six joints of the antennæ, the base of the tibiæ, and the tarsi fulvous;

thorax finely and moderately punctured; elytra distantly punctate-striate.

Length 2–2½ millim.

Ovate, very convex, pointed posteriorly; the head finely and rather obscurely punctured, with a short central obsolete groove; labrum fulvous; antennæ widely separated at the base, long and slender, the lower six joints fulvous, the rest black, second joint nearly as long as the third, but thicker; thorax transverse, of nearly equal width, the lateral margins straight, the surface finely, remotely, and irregularly punctured, the sides nearly impunctate near the margins; scutellum blackish, trigonate; elytra widened at the middle, very convex, pointed at the apex, finely punctured in distantly placed rows, with other punctures here and there on the interstices; femora thickened, unarmed, dark blue, the apex fulvous; anterior tibiæ entirely fulvous, the others of this colour at the base only, the apex obscure æneous; tarsi fulvous.

Hab. Upper Tongaat, Natal (*C. Barker*).

This is the third known species of the genus (Proc. Zool. Soc. 1897, p. 546, 1898, p. 228). It differs from *P. natalensis* Jac. in the colour of the antennæ and legs, and in the much more finely punctured thorax and elytra; from *P. æneus* Jac. in having the basal six, instead of four, joints of the antennæ fulvous, and in the much more slender and elongate legs. In regard to *P. natalensis* in which the elytra have two short humeral costæ, this character is only peculiar to the female sex; of the insect described here Mr. Barker has sent two specimens, evidently also females, in which the first joint of the tarsi is rather elongate. All the species of the genus are of somewhat spider-like appearance and resemble the genus *Pallena*, which, however, belongs to the first division of the Eumolpidæ, with a concave, not convex, anterior thoracic episternum.

Liniscus interstitialis, sp. n.

Piceous with æneous gloss; antennæ and legs dark fulvous; thorax very closely punctured; elytra obscure æneous, regularly punctate-striate, the interstices with a fine row of punctures.

Length 3 millim.

Narrowly subcylindrical, the head very closely and strongly punctured, the clypeus feebly separated from the face, eyes oblong, slightly sinuate; antennæ dark fulvous, the terminal five joints strongly widened, third joint one-half longer than the second, basal joint subquadrately widened; thorax scarcely one-half broader than long, the sides rounded, rather strongly widened at the middle, the disc punctured like the head; elytra of slightly paler colour than the thorax, with more or less æneous gloss, rather strongly punctate-striate anteriorly, the interstices with a single row of very fine punctures; legs robust, obscure piceous or dark fulvous; femora unarmed; claws very finely bifid at the base only.

Hab. Beira, E. Africa (*A. Sheppard*).

Readily distinguished from the other species of this genus by the punctured elytral interstices.

PAUSIRIS O'NEILI, sp. n.

Cupreous, closely covered with white patches of pubescence, apical joints of the tarsi and the tibiæ sometimes obscure fulvous; head very finely, thorax and elytra strongly and closely punctured.

Length 3 millim.

Oblong, parallel, the head finely and rather remotely punctured, clothed with white hairs; antennæ with the terminal five joints strongly widened, the lower two joints cupreous, the others obscure fulvous or piceous; thorax about one-half broader than long, the sides widened and rounded at the middle, obsoletely margined, the surface closely and strongly punctured, of a brassy cupreous, closely covered with white adpressed hairs; scutellum subquadrate, closely pubescent; elytra wider at the base than the thorax, subcylindrical, parallel, sculptured and pubescent like the thorax, the hairs arranged in small patches forming irregular transverse bands; legs rather slender, tibiæ more or less fulvous.

Hab. Dunbrody, Cape Colony (*Rev. J. A. O'Neil*).

Of more parallel shape than *P. subfasciatus* Jac. from the same locality, the punctuation of the thorax and elytra much stronger, the pubescence differently arranged and denser and the punctuation extremely close, almost rugose.

PAUSIRIS LONGICOLLIS, sp. n.

Dark æneous, the tibiæ and tarsi fulvous; thorax rather long, closely punctured, sparingly pubescent; elytra closely punctate-striate, pubescent.

Length 2 millim.

Head strongly punctured, the epistome not separated, carinate at the sides, its anterior edge nearly straight; antennæ dark fulvous, the joints more or less æneous above, the terminal five distinctly thickened; thorax proportionately long, widened at the base, the sides rounded, the anterior margin accompanied by an obsolete transverse sulcus, the disc closely punctured, the punctures of elongate shape, the interstices sparingly clothed with white hairs; scutellum subquadrate; elytra wider at the base than the thorax, obsoletely transversely depressed below the base, more strongly punctured than the thorax in closely approached rows, sparingly furnished with white hairs; femora æneous, tibiæ and tarsi fulvous.

Hab. Dunbrody, Cape Colony, on *Euphorbiæ* (*Rev. J. A. O'Neil*).

Of metallic-bronze colour; the thorax more elongate than in the other species of the genus and obsoletely grooved anteriorly; the pubescence may have been rubbed off partly, as the insect is more shining than most of its allies; the underside and the prosternum are strongly and closely punctured. The two specimens which I received from the Rev. J. A. O'Neil are probably females, as the anterior tarsi are not broad.

PAUSIRIS FEMORALIS, sp. n.

Dark cupreous, clothed with white pubescence; antennæ and

legs dark fulvous; thorax transverse, finely punctured; elytra more strongly punctured, the pubescence arranged in rows; femora with a very small tooth.

Length 2 millim.

Head closely and rather strongly punctured, cupreous, clothed with long white pubescence; labrum fulvous, anterior margin of the epistome triangularly emarginate; eyes oblong, rather large; antennæ with the terminal four joints strongly dilated, the preceding joint triangularly elongate, all fulvous, the last ones slightly darker; thorax about one-half broader than long, the sides rounded, slightly widened at the middle, sculptured and pubescent like the head; scutellum subquadrate, pubescent; elytra wider at the base than the thorax, more strongly punctured than the latter, the punctuation close, the base with an obsolete transverse depression, the surface pubescent like the other parts; underside darker æneous, finely and closely punctured; prosternum subquadrate, strongly punctured; femora with a minute tooth, fulvous like the tibiæ and tarsi or stained with æneous.

Hab. Lower Tugela, Natal (*C. Barker*).

This species, although possessing all the structural characters of *Pausiris*, differs from the other members of the genus in having the femora armed with a small tooth and in the rather broader prosternum. I am not certain as to the sex of the two specimens which I received from Mr. Barker, but they are probably both females.

PAUSIRIS SEMIRUGOSUS, sp. n.

Dark æneous, finely pubescent; antennæ black, head strongly, thorax extremely closely punctured; elytra strongly and closely punctate-striate, the interstices at the sides transversely rugose.

Length 3 millim.

Head strongly and closely punctured, the interstices minutely granulate, the lateral margins of the epistome carinate, the anterior margin nearly straight; antennæ nearly black, the basal joint obscure fulvous below, the terminal five joints thickened, the last more elongate and pointed; thorax about one-half broader than long, the sides strongly rounded and widened at the middle, the surface crowded with elongate punctures and clothed with fine white pubescence; scutellum transverse, subquadrate; elytra distinctly broader at the base than the thorax, very obsoletely depressed below the former, with regular and closely placed rows of strong punctures, which are finer but distinct towards the apex, the interstices at the sides transversely rugose (when viewed sideways) and covered with fine pubescence like the thorax; legs black with æneous gloss; prosternum strongly punctured, femora unarmed.

Hab. Grahamstown (*Ledoux*).

This little *Pausiris* may be known from its allies by the sharply rounded sides of the thorax and its strong and close punctuation, by the regular and closely punctate-striate elytra

and their rugose sides, in connection with the dark æneous colour and black antennæ. I received two specimens of this species from the Rev. J. A. O'Neil, who obtained them from M. Ledoux, the discoverer of the species.

MACETES RUGICOLLIS, sp. n.

Cupreous, clothed with white pubescence; apical joints of the antennæ black; head and thorax finely, confluently rugose; elytra with a few fine punctures and white pubescence arranged in longitudinal bands.

Length 5 millim.

Subquadrate, ovate; the head entirely longitudinally strigose, the strigæ confluent, the interstices finely pubescent, anterior margin of the epistome semicircularly emarginate; labrum metallic green, alutaceous; antennæ extending to the base of the elytra, the lower six joints cupreous, the others black, strongly incrassate; thorax transverse, slightly constricted at the base and apex, the lateral margins distinct, the surface sculptured like the head; scutellum subpentagonal; elytra with a short but distinct depression below the base, the latter with a few fine punctures, the rest of the disc scarcely perceptibly punctured, with four more or less distinct bands of white hairs; anterior and posterior femora dentate, thickened; underside and legs clothed with short white pubescence.

Hab. Lower Tugela, Natal (*C. Barker*).

Quite distinct, on account of the sculpture of the head and thorax, from any other species of the genus. I have received a single specimen from Mr. Barker.

MACETES PUSILLA, sp. n.

Greenish æneous, pubescent, the labrum, antennæ, tibiæ, and tarsi fulvous; thorax transverse, closely and finely punctured and pubescent; elytra with basal depression, more strongly punctured than the thorax, clothed with white pubescence; anterior and posterior femora dentate.

Length 3 millim.

Of oblong, subquadrate shape; the head closely and rather strongly punctured, clothed with longish white pubescence; epistome triangularly emarginate at its anterior edge; labrum and palpi fulvous; antennæ rather long, fulvous, the terminal five joints dilated, the last one longer than broad; thorax about one-half broader than long, the sides rounded, anteriorly deflexed when viewed from above, the lateral margins obsolete, the surface rather convex, with an obsolete transverse groove near the anterior margin, finely and closely punctured and clothed with white hairs, which, at the middle, form a more or less distinct stripe; scutellum subquadrate, pubescent; elytra wider at the base than the thorax, with a distinct depression below the raised basal portion, the shoulders prominent, closely and irregularly punctured, the punctures larger at the anterior portion than

posteriorly, the colour dark greenish æneous, all the punctures provided with longish white hairs; the femora æneous or cupreous, the anterior and posterior ones dentate; tibiæ and tarsi fulvous.

Hab. Ifafa Mountains, Natal (*C. Barker*).

Of this, the smallest species of the genus, I received two, evidently female, specimens from Mr. Barker; from *Pausiris* the tooth of the anterior and posterior femora and the shape of the last joint of the antennæ distinguish the genus *Macetes*.

EURYOPE BARKERI, sp. n.

Above reddish fulvous, below and the legs black; head and thorax with a central black spot, finely and closely punctured; elytra ovate, an angulate short transverse band at the base and two elongate spots near the apex black.

Length 7 millim.

Head finely punctured, very closely so at the anterior portion, with the interstices finely rugose, the vertex with a black spot: antennæ with the basal six joints black (the rest wanting), lower two joints fulvous at the apex; thorax more than twice as broad as long, the sides straight, anterior angles obliquely thickened, the surface strongly convex, very closely and finely punctured at the sides, with the interstices slightly rugose, the middle with a nearly smooth, narrow space and a small black spot; scutellum black; elytra short and ovate, strongly convex, widened towards the apex, the shoulders strongly swollen in shape of a short ridge which gradually diminishes posteriorly, the disc very finely punctured in irregular rows, a short band extends from the base to below the shoulders, where it turns at right angles towards the suture without extending to it, this band is strongly constricted at the middle, below the latter are two elongate spots placed side by side; underside and legs black.

Hab. Lower Tugela, Natal (*C. Barker*).

Allied to *E. terminalis* Baly, but with the lower parts and legs black, the thorax with a single central spot only, the humeral stripe of different shape and position, and the elytra more sparsely and finely punctured, the latter also shorter and widened below the middle. I received a single specimen from Mr. Barker; others are in that gentleman's possession.

COLASPOSOMA SHEPPARDI, sp. n.

Dark æneous, the basal joints of the antennæ fulvous; thorax very strongly and closely punctured; elytra with basal depression, very strongly transversely rugose at the sides, closely punctured like the thorax, each elytron with a short transverse ridge near the apex; anterior femora with a tooth.

Length 5 millim.

Head strongly punctured, with a central longitudinal groove, the latter and the base of the antennæ reddish cupreous, rest of the surface dark æneous; clypeus punctured like the head; antennæ slender, the six lower joints fulvous, the others black,

basal joint piceous above; thorax with the sides rounded at the base, narrowed in front, the disc closely and strongly punctured; elytra with a deep transverse basal depression, punctured like the thorax, the entire sides strongly transversely rugose, the inner disc with a costa near the suture at the posterior portion which near the apex curves round at right angles and runs parallel to the lateral margin; underside and legs dark æneous, the anterior femora with a short tooth.

Hab. Beira, E. Africa (*A. Sheppard*).

I have received from Mr. Sheppard two apparently female specimens of this species which I cannot identify with any hitherto known *Colasposoma*. At the base of the elytra traces of other costæ are visible; the coarse elytral punctuation, the very strong rugosities, and the subsutural and apical costæ are the principal marks of distinction of this species, also its dull æneous colour.

COLASPOSOMA PUSILLUM, sp. n.

Obscure cupreous or æneous below, above metallic green; antennæ obscure fulvous; thorax short and convex, crowded with larger and smaller punctures; elytra oblong-ovate, semi-regularly punctured in rows, the interstices at the sides finely transversely rugose, femora metallic green.

Mas. Tibiæ slightly curved, cupreous.

Fem. Thorax very short; tibiæ straight, fulvous as well as the tarsi.

Length 4 millim.

Mas. Head rather closely and finely punctured, the epistome very feebly separated from the face by an obsolete groove, its anterior margin often narrowly cupreous, very slightly emarginate at the middle; labrum dark fulvous; antennæ long and slender, dark fulvous, the third joint distinctly shorter than the fourth; thorax short and very strongly transverse, the sides strongly rounded, the surface crowded with small and larger punctures; anterior angles produced into a short tooth; scutellum broad, subpentagonal, impunctate; elytra with a shallow transverse depression below the base, more strongly punctured than the thorax, the punctures arranged in closely approached rows, the interstices slightly rugose on the disc, more distinctly and transversely so at the sides; femora robust; prosternum finely rugose, broad, more or less cupreous.

Hab. Upper Tongaat, Natal (*C. Barker*).

I would have referred this little species to *C. parvulum* Lefèv. (Trans. S. Afr. Philos. Soc. 1890, p. 42), to which, at all events, it must be very closely allied; but the author describes the thorax as extremely short, and rather strongly and subconfluently punctured, and the legs as fulvous, with the knees metallic green; the sex of his specimen is not given. In the present species the female has a shorter, less transverse and convex thorax and straight tibiæ, also less robust femora; in the elytral punctuation, however, there is scarcely any difference.

COLASPOSOMA PICEITARSE, sp. n.

Pale fulvous with strong metallic green lustre, the antennæ and legs entirely fulvous, the tarsi piceous; thorax very closely and finely punctured, with rounded sides; elytra closely and strongly punctured anteriorly, much more finely so towards the apex.

Length 5–6 millim.

Head closely and slightly rugosely punctured, metallic green, the sides of the clypeus in the male rather strongly raised, its anterior margin but slightly concave; labrum and palpi fulvous, the apical joint of the latter piceous; antennæ long and slender, entirely fulvous, the third and fourth joints equal, one-half longer than the second joint; thorax of even width, the sides strongly rounded, narrowly marginate, all the angles acute, the disc convex, closely and finely punctured; elytra with a distinct transverse depression below the base, strongly punctured within the depression and at the sides only, the rest more finely and somewhat regularly punctate; legs pale fulvous as well as the underside, the latter with strong metallic green gloss, the tarsi piceous.

Hab. Upper Tongaat, Natal (*C. Barker*).

Closely and more nearly allied to *C. fulvipes* Lef. than to any of its other numerous allies, but I think a distinct species, of which I have seven specimens before me; the principal distinctive characters are the pale ground-colour (especially when held in certain positions), strongly shot with metallic green, and the nearly black tarsi; the elytral punctuation also is much finer from the middle downwards than in *C. fulvipes*. *C. bonvouloiri* Lef. has likewise black tarsi, but is of different general colour and is described as having longitudinal striæ at the sides.

COLASPOSOMA CUPRICOLLE Fairm.

I refer, not without doubt, two specimens, which I received from M. Clavareau, and which were obtained at Mozambique, to this species; they agree in most respects, but the elytra are purplish with a bluish tint, and the underside and legs are violaceous blue; the elytra are not dilated at the base as Fairmaire's description says. As to the sex, the author, as usual, makes no mention, and as both sexes in *Colasposoma* are often quite differently sculptured, it is impossible to know with which of his species to compare a particular form; Fairmaire describes his species from Madagascar (Ann. Soc. Ent. Belg. 1902, p. 262).

COLASPOSOMA ANTENNALE Jac.

Of this species I have received several specimens from Mr. Barker with the locality Ifafa Mts., Natal; they differ slightly from the type in having the terminal joints of the antennæ more or less piceous. In my description of the species (Proc. Zool. Soc. 1881, p. 444) I stated that the elytral interstices are transversely rugose throughout, but this is scarcely correct; I should have

said "at the sides," as the space near the suture is scarcely visibly rugose; some specimens are of an æneous colour above with the interior of the punctures metallic green.

COLASPOSOMA BALYI, sp. n.

Dark blue or violaceous; thorax with feebly rounded sides, extremely closely and strongly punctured; elytra of nearly similar sculpture, the sides scarcely rugose.

Length 9–10 millim.

Mas. Head strongly punctured, the sides rugose, clypeus rather more finely and closely rugose-punctate, labrum black; antennæ entirely bluish black, the terminal joints strongly widened; thorax not very strongly convex, the sides feebly rounded, the anterior angles acutely pointed in shape of a small tooth, the disc extremely closely evenly and strongly punctured, the punctures round and deep, the interstices very slightly wrinkled at the sides; scutellum broader than long, punctured at the base; elytra punctured like the thorax, the punctures very closely placed, the interstices slightly rugose at the sides; penis rather slender, strongly curved, the apex triangularly pointed; anterior tibiæ dilated and curved at the apex.

Hab. Dar-es-Salaam, E. Africa.

Allied to *C. kraatzi* Jac., but less shining, the upper surface strongly and much more closely punctured, the punctures of the thorax and the elytra equally strong. The female does not seem to differ from the other sex excepting in the straight and not dilated anterior tibiæ. In *C. variabile* Jac. the male has a strongly convex and rather dilated thorax and the elytra are strongly transversely rugose at the sides.

COLASPOSOMA ASPERATUM Fairm. (Ann. Soc. Ent. Belg. 1902, p. 262).

This name has long ago been used by Lefèvre for an Indian species (Catal. Eumolp. 1885, p. 104): I therefore alter it to *C. perrieri*, nom. n.

COLASPOSOMA BEIRAENSE, sp. n. (Plate XVII. fig. 10.)

Dark blue below, above cupreous, the anterior portion of the head and two basal spots on the thorax dark blue; head and thorax densely punctured; elytra finely punctured, the sides finely transversely rugose, the sutural and lateral margins metallic blue.

Length 6–7 millim.

Mas. Head opaque, finely and closely punctured and granulate, flat, without depressions, cupreous, the lower portion in shape of a triangular patch, dark blue, this colour dividing in a narrow line the cupreous portion; labrum piceous; antennæ with the lower five joints dark fulvous, the basal joint above and the terminal joints piceous, all the joints with the exception of the first slender; thorax strongly transversely convex, the sides strongly rounded, narrowed anteriorly, the angles not produced,

the disc crowded with small punctures, which at the sides are somewhat confluently rugose, cupreous, more shining than the head, all the margins narrowly dark blue, the base with two large transverse, irregular blue patches; scutellum dark blue, finely punctured at the base; elytra without basal depression, cupreous, moderately shining, the suture and the lateral margins dark blue, the disc finely punctured in rows near the suture, more irregularly so at the sides, where the interstices are finely transversely wrinkled; underside and legs dark violaceous blue, finely pubescent, the anterior tibiæ slightly curved; femora unarmed.

Hab. Beira, E. Africa (*A. Sheppard*).

This species is not difficult to recognise on account of its system of coloration and the opaque, non-impressed head; the elytral lateral rugosities are very fine, extend to the apex, and are finely pubescent near the lateral portion; the female has much shorter antennæ and straight tibiæ, but does not differ in any other respect.

COLASPOSOMA MIRABILE, sp. n.

Cupreous below, above metallic green, sides of the head dark purple; thorax finely and subremotely punctured, with six purplish bands; elytra strongly and closely punctured, the sides transversely rugose and with a longitudinal costa, each elytron with two purplish, broad, longitudinal bands.

Length 5 millim.

Fem. Head rather closely punctured and minutely granulate, without depressions, the sides reddish cupreous, a central narrow line at the vertex and the clypeus metallic green; labrum black; antennæ with the terminal joints thickened, black, the lower three joints fulvous, the following two greenish; thorax rather short, the sides moderately rounded, slightly narrowed anteriorly, the disc finely and rather remotely punctured, metallic green, the sides and four longitudinal bands dark cupreous; scutellum finely punctured, cupreous; elytra strongly punctate-striate near the suture, the sides strongly transversely rugose, with an acutely raised longitudinal costa from below the shoulders, the suture narrowly and a broad lateral band metallic green, rest of the surface dark cupreous; below cupreous, finely pubescent, the anterior femora with a small tooth.

Hab. Luitpoldkette, E. Africa.

In its coloration this species much resembles *C. viridivittatum* Baly, but is of much less convex shape and smaller, the punctuation of the thorax is totally different and also its coloration; this different sculpturing distinguishes the species likewise from *C. variabile* Jac., which is also more than twice as large. I unfortunately know the female sex only; the male is probably devoid of the elytral costæ.

COLASPOSOMA CYANEO-CUPREUM Fairm. Ann. Soc. Ent. Fr. sér. 6, vii. p 352 (1887).

C. junodi Péring. Ann. S. Afr. Mus. i. p. 556 (1899).

LEFEVREA FULVICOLLIS, sp. n.

Fulvous, the thorax closely and strongly punctured; elytra black, closely and regularly punctate-striate, femora with a minute tooth.

Length 4 millim.

Head strongly punctured, fulvous; epistome not separated, its anterior margin but slightly emarginate; antennæ filiform, pale fulvous, the apex of the terminal joints piceous, the last four joints slightly thickened and shortened, thorax about one-half broader than long, fulvous, the sides rounded and obliquely narrowed anteriorly, the anterior angles in shape of a small tooth, produced outwards, the posterior ones placed rather inwards, the lateral margins forming an obscure angle at the base, the surface very closely and strongly punctured; scutellum fulvous; elytra subcylindrical, parallel, black, the base without depression, the disc strongly and closely punctate-striate, the interstices at the sides rather strongly longitudinally costate; underside and legs fulvous, the breast sometimes piceous, the femora with a small tooth.

Hab. Umtali, Natal (*C. Barker*).

At once distinguished from any other species of the genus by its coloration in connection with the strongly punctured thorax. The sexes were taken *in coitu* by Mr. Barker; the female does not differ from the male except in being slightly larger.

EUBRACHYS O'NEILI, sp. n.

Obscure violaceous or purplish, the basal joints of the antennæ and the tibiæ obscure fulvous or piceous; thorax subglobular, very finely punctured and pubescent; elytra of similar sculpture, clothed with short silvery pubescence arranged in lines.

Length 2½–3 millim.

Head closely punctured at the sides, finely strigose at the vertex, the interstices sparingly pubescent and minutely granulate; antennæ with the lower seven joints fulvous, the rest black; thorax strongly rounded at the middle, the apex and the base constricted, the disc sculptured like the head and clothed with very short silvery pubescence; elytra with the shoulders prominent, the apex rounded, the punctuation much finer than that of the thorax, nearly obsolete, the interstices clothed with short, stiff, silvery hairs, arranged in closely approached rows; femora strongly toothed, tibiæ obscure fulvous.

Hab. Grahamstown, S. Africa; on *Chrysocoma tenuifolia* (Compositæ) (*Rev. J. A. O'Neil*).

A pair of this species taken "*in coitu*" were kindly sent to me by the Rev. J. A. O'Neil. The insect is perhaps more nearly allied to *E. chrysitis* Gerst. than to any other, but it is devoid of the longer stiff silvery pubescence peculiar to that species, and well distinguished from that and several other closely allied species by the scarcely perceptible punctuation of the elytra in connection with the sombre, obscure purplish or violaceous coloration. Weise

has lately pointed out, and rightly so, that most of the species described under *Pseudocolaspis* belong to *Eubrachys* Baly, on account of the concave, not convex, anterior margin of the thoracic episternum. The genus therefore requires revision when the types can be compared.

ECHTRUSIA CAPENSIS, sp. n.

Ovate, æneous, antennæ piceous, apex of the tibiæ fulvous; head and thorax finely punctured, punctures of the latter elongate; elytra sparingly pubescent, finely punctured.

Length 3 millim.

Head rather flattened, finely and closely punctured, apex of the epistome triangularly emarginate, the lower joints of the antennæ obscure cupreous, the terminal five joints piceous, strongly thickened; thorax about one-half broader than long, strongly narrowed anteriorly, the sides nearly straight, the margins distinct, the disc closely and finely impressed with elongate punctures, which are more crowded at the sides; scutellum transverse, its apex rounded; elytra ovate, convex, the sides strongly rounded, the lateral margins below the shoulders oblique, the surface finely and closely punctured and sparingly pubescent; femora strongly thickened, unarmed, prosternum very broad, claws bifid.

Hab. Dunbrody, Cape Colony (*Rev. J. A. O'Neil*).

I have received a single specimen from the Rev. J. A. O'Neil, the sex of which is uncertain. It is the second species of the genus established by Lefèvre, and differs from the type in being smaller, in having differently coloured antennæ and legs, and the thorax impressed with elongate punctures; it is possible that the elytra in the specimen before me are partly rubbed as regards the pubescence. The broad and rounded scutellum, very broad prosternum and mesosternum, and the strongly narrowed thorax separate the genus from *Pallena* and allied genera.

SCELODONTA RUGIPENNIS, sp. n.

Dark cupreous, the apical joints of the antennæ black; thorax finely transversely wrinkled; elytra confluently rugose-punctate, the interstices finely costate at the apex with single white hairs, sides of the breast densely pubescent.

Length 4 millim.

Head strongly rugose, the vertex with a central groove, supraocular sulci very deep; antennæ with the lower joints cupreous, the last five black, strongly widened; thorax scarcely wider than long, the sides widened at the middle, the whole surface finely transversely wrinkled; elytra transversely depressed below the base, narrowed at the apex, closely confluently punctured throughout, the punctures stronger at the base than posteriorly, the interstices at the apex with a few short costæ and sparingly provided with single whitish hairs; parapleuræ of the breast clothed with dense white pubescence.

Hab. Ifafa Mountains, Natal (*C. Barker*).

Very closely allied to *S. sexplagiata* Jac., likewise from Natal, but without any elytral spots and their sculpturing entirely irregular, not arranged in rows, the flanks of the thorax also without the band of dense pubescence so prominent in the other species. I received three specimens from Mr. Barker.

SCELODONTA LEFEVREI, sp. n.

Dark cupreous, pubescent, the antennæ (the basal joint excepted) black; thorax densely transversely strigose; elytra strongly punctured in rows, the interstices rugose and pubescent, each elytron with five fuscous spots 2 . 2 . 1; femora dentate.

Length 4 millim.

Head finely rugose-punctate and sparingly pubescent, the vertex convex without groove, ocular sulci very deep and broad; antennæ black, the lower three joints cupreous; thorax transverse, of usual shape, strongly transversely strigose, the interstices sparingly punctured and furnished with single white hairs, cupreous, the sides with a very obscure fuscous band; scutellum pentagonal, with a few hairs; elytra obliquely shaped at the shoulders, deeply and closely punctured in rows, the interstices transversely rugose, the shoulders, an elongate spot at the middle of the base, two roundish spots placed transversely below the middle and another more elongate one near the apex at the sides, fuscous, interstices at the apex costate, sides of the thorax below and of the breast densely pubescent; femora with a very short tooth.

Hab. Beira, E. Africa (*A. Sheppard*).

Nearly allied to *S. vicina* Har. and *S. maculosa* Lefèv., but the position and the shape of the elytral spots quite different, the pubescence also much longer; the longitudinal elytral depressions in *S. vicina* are also absent in the present species, of which I received three specimens from Mr. Sheppard.

CHEIRIDELLA, gen. n.

Body oblong, pubescent; antennæ filiform, the third joint twice as long as the second; thorax one-half broader than long, not widened, with distinct lateral margins, the angles dentiform, surface pubescent; elytra finely punctured in rows, closely pubescent, femora thickened, the anterior and posterior ones with a strong tooth, tibiæ simple, claws appendiculate; prosternum very narrow between the coxæ, elongate, anterior margin of the thoracic episternum concave.

There is no group of *Eumolpidæ* into which the present genus can be satisfactorily placed, since the pubescent upper surface agrees with that of the *Heteraspinæ*, in which the posterior tibiæ are, however, emarginate and the claws bifid; in the *Odontionopinæ* the claws are appendiculate, but the intermediate tibiæ are

emarginate and the upper surface is glabrous; the genus is therefore transitional between these and allied groups.

CHEIRIDELLA ZAMBESIANA, sp. n.

Fuscous or fulvous, underside black; head and thorax clothed with fine grey pubescence; elytra similarly pubescent, finely punctured in closely approached rows.

Length 5 millim.

Head finely rugose, the epistome not separated; eyes ovate, entire; antennæ slender, fulvous, the basal two joints thickened, the third slightly longer, shorter than the following joints, terminal ones scarcely thicker; thorax twice as broad as long, of very nearly equal width, the sides rounded at the middle, slightly constricted at the base and apex, the angles not produced, the disc rather convex, black, closely covered with greyish pubescence, the interstices finely granulose; scutellum scarcely broader than long, its apex obtusely rounded; elytra not wider at the base than the thorax, slightly widened posteriorly, convex, opaque, closely and extremely finely punctured in rather ill-defined rows and clothed with long greyish pubescence; underside slightly more shining; the femora rather thickened, the anterior ones with a distinct tooth, the others very minutely dentate.

Hab. Estcourt, Natal.

In one specimen the legs are black, with the exception of the base of the femora which is fulvous and the tarsi are feeble and slender; but in another, probably the male, they are slightly broader.

CASMENELLA, gen. n.

Subelongate, convex, pubescent; antennæ filiform, the second joint shorter than the third; thorax twice as broad as long, slightly constricted anteriorly and posteriorly, with distinct lateral margins; elytra finely punctured in rows, pubescent; femora thickened, the anterior with a distinct tooth; tibiæ scarcely sulcate, the intermediate slightly emarginate at the apex, claws bifid; prosternum very narrow, the anterior margin of the thoracic episternum concave.

This genus will enter the *Heteraspinæ* of Chapuis' arrangement, and is very nearly allied to *Casmena* Chap., but differs in the strongly transverse thorax, the much shorter femora, and the absence of the long tooth with which the posterior femora are provided in *Casmena*. In *Casmena* the thorax is scarcely one-half broader than long. In *Casmenella* the intermediate and posterior femora have a very minute tooth, but that of the anterior femora is well developed.

CASMENELLA NATALENSE, sp. n.

Black, opaque, clothed with fine white pubescence; antennæ fulvous, thoracic punctuation finely rugose; elytra with very fine rows of punctures and adpressed whitish hairs; legs fulvous.

Var. Legs black, the base of the femora fulvous.

Length 3–3½ millim.

Head broader than long, the epistome not separated from the face, eyes large, entire, the surface finely rugose, clothed with whitish pubescence, labrum fulvous; antennæ long and slender, fulvous, the basal joint short and thick, the second and third subequal, short, the others elongate, terminal joints slightly tipped with piceous; thorax short, quite twice as broad as long, the sides feebly rounded, the surface sculptured and pubescent like the head; scutellum subquadrate, densely pubescent; elytra convex, subcylindrical, black, opaque, closely and finely punctured in rows, pubescent like the thorax; legs fulvous.

Hab. Estcourt, Natal.

Nerissella, gen. n.

Oblong, pubescent; head elongate; the epistome not separated; antennæ short, the terminal joints transversely widened; thorax narrowed anteriorly, with distinct lateral margins; scutellum subquadrate, its apex nearly truncate; elytra irregularly punctured, closely pubescent; femora thickened, unarmed, tibiæ dilated at the apex, claws bifid; anterior margin of the thoracic episternum concave; prosternum broad.

The species for which this genus is proposed will best find its place amongst the *Pseudocolaspinæ* on account of the structure of the antennæ, pubescent upper surface, non-emarginate tibiæ, bifid claws, and the shape of the thoracic episternum. The genus differs from *Pseudocolaspis* proper in the distinct and entire lateral margins of the thorax and unarmed femora, from *Palesida* Har. in the entirely different shape of the head and thorax, these differences also separating the genus from the other members of the group.

Nerissella curculionoides, sp. n.

Greenish æneous, clothed with white pubescence; antennæ blackish, head and thorax closely punctured; elytra subelongate, punctured like the thorax, clothed with long whitish pubescence.

Length 4 millim.

Head elongate and narrowed in front, convex, without any depressions, closely punctured, with short pubescence; the epistome not separated, its anterior margin semicircularly emarginate; eyes rounded, entire; antennæ widely separated, inserted below the eyes, not extending to the base of the thorax, the terminal five joints bluish black, transversely thickened, the other joints obscure fulvous, the second joint thickened, longer than the third and following joint; thorax about one-half broader than long, narrowed anteriorly, closely and strongly punctured, and clothed with rather long, adpressed, white hairs; scutellum broad, its apex nearly truncate; elytra slightly wider at the base than the thorax, oblong, nearly parallel, sculptured and pubescent like the thorax;

underside and legs of similar sculpturing, the first joint of the anterior tarsi rather strongly dilated (♂?); the lower surface of the tarsi covered with fulvous pubescence.

Hab. Zambesi.

The general appearance of this small species is not unlike that of a species of Curculionid on account of the narrowed and convex head without the slightest division or groove; the general colour is a greenish and very metallic lustre in spite of the white pubescence.

CHRYSOMELINÆ.

ALGOALA, gen. n.

Body ovate, pointed posteriorly, apterous; antennæ filiform, palpi slender; thorax transverse, narrowed anteriorly, the sides oblique, straight, not thickened; scutellum triangular; elytra slightly wider at the base than the thorax, punctate-striate, their epipleuræ very broad, impubescent; legs rather feeble, claws simple; prosternum narrowed between the coxæ; mesosternum short, quadrate; metasternum short and transverse; anterior coxal cavities closed.

In the shape of its thorax this genus resembles *Melasoma*, from which it is at once separated by the filiform antennæ; the closed anterior cavities and the absence of wings as well as the general shape will further assist in the recognition of the genus, of which I received a single species from Dr. Brauns.

ALGOALA FULVICOLLIS, sp. n.

Fulvous, thorax strongly punctured at the sides, the middle finely punctate; elytra greenish æneous, strongly and closely punctate-striate.

Length 5 millim.

Head rather closely punctured, fulvous, the space in front of the eyes strongly thickened, the clypeus more finely and closely punctured, more or less distinctly separated from the face; antennæ scarcely extending to the middle of the elytra, fulvous, the basal joint subquadrate, the second small, the third joint longer than the following ones, terminal joint elongate; thorax of somewhat variable shape, according to sex, the sides rounded in the male, more straight and obliquely narrowed in the female, the disc sparingly and finely, the sides closely and strongly punctured; scutellum triangular; elytra with about twelve rows of strong punctures, obscure greenish æneous, a narrow space in front of the lateral margins impunctate and slightly convex; underside and legs fulvous.

Hab. Algoa Bay, Cape Colony (*Dr. Brauns*).

TIMARCHELLA, gen. n.

Ovate, apterous; palpi elongate, cylindrical, the last joint subconical, shorter than the preceding one; antennæ elongate, robust,

the basal joint thickened, subquadrate, the second short, third and following joints nearly equal; thorax transverse, convex, the sides strongly rounded and widened at the middle, slightly constricted at the base, the basal margin with a depression at each side, anterior margin straight, anterior angles obtuse, posterior ones distinct but not produced, the surface irregularly punctured and rugose; scutellum trigonate; elytra widened at the middle, pointed at the apex, with closely arranged rows of punctures, the interstices more or less convex, their epipleuræ broad, non-pubescent; legs slender, the tibiæ gradually widened and sulcate, third joint of the tarsi scarcely lobed, claws simple; prosternum narrowly elongate; mesosternum short; metasternum transverse and very short; anterior cotyloid cavities closed.

As will be seen by the above-given details, the insect for which this genus is proposed is allied to *Timarcha* and *Strumatophyma* and partly to *Colaphus* and *Cyrtonus*, but with the last two genera it has only a somewhat similar appearance in common, as the closed anterior cavities remove the species from these groups. The shape of the palpi, narrow prosternum, and general differences in shape, &c., separate the genus from the two first-named genera. *Potaninia* Weise is certainly also very closely allied, but is winged, the thorax is of different structure, and the prosternum is much wider; the legs also differ. (The insect upon which Weise founded his genus had been previously described by Baly as *Entomoscelis assamensis*.) *Semenowia* Weise agrees with *Timarchella* in the wingless body, but as the author says nothing about the state of the coxal cavities and places the genus near *Chrysomela*, these parts are presumably open.

TIMARCHELLA BRAUNSI, sp. n.

Obscure æneous, opaque, the antennæ and legs dark fulvous, thorax coarsely punctured; elytra closely punctate-striate, the interstice longitudinally convex.

Length 6 millim.

Head finely punctured, with an elongate triangular fovea, more or less fulvous with æneous gloss; antennæ dark fulvous, extending to about the middle of the elytra; thorax transverse, convex, constricted at the sides near the base and to a less extent anteriorly, the surface unevenly and coarsely punctured, with a broad but rather obsolete depression at the base near the posterior angles, the lateral margins slightly thickened; elytra with twelve rows of closely placed and distinct punctures, the interstices slightly (♂) or more strongly and interruptedly (♀) convex; below and the legs fulvous.

Hab. Willowmore, Cape Colony (*Dr. Brauns*).

I received both sexes from Dr. Brauns; the male organ is slender, subcylindrical, and strongly pointed, with a longitudinal sulcus above; in the female, the elytral interstices form short elongate tubercles near the suture and the others are more distinctly convex than in the male; the general colour is a dull

æneous shaded to fulvous on the head and less distinctly so on the thorax.

EXPLANATION OF PLATE XVII.

Fig. 1. *Lema æthiopica*, p. 233.
2. *L. humeronotata*, p. 234.
3. *Cryptocephalus subconnectens*, p. 243.
4. *C. sexplagiatus*, p. 246.
5. *C. beiraensis*, p. 244.
6. *C. sheppardi*, p. 242.
7. *Cryptocephalus o'neili*, p. 243.
8. *Miopristis o'neili*, p. 236.
9. *Damia trifasciata*, p. 240.
10. *Colasposoma beiraense*, p. 261.
11. *Menius brevicornis*, p. 251.
12. *Eurydemus geniculatus*, p. 250.

3. The Polychæta of the Maldive Archipelago from the Collections made by J. Stanley Gardiner in 1899. By CYRIL CROSSLAND, B.A., B.Sc., F.Z.S., the Gatty Laboratory, St. Andrews.

[Received December 15, 1903.]

(Plates XVIII. & XIX.* and Text-figures 38–42.)

CHÆTOPTERIDÆ and part of the EUNICIDÆ.

NOTE.—It was at first intended to publish these results as part of Gardiner's 'Fauna and Geography of the Maldive Islands,' as indicated by the references in my paper on *Phyllochætopterus* from East Africa (P. Z. S. 1903, vol. i. p. 169). Since, however, it is now evident that a great simplification of the literature of the group can be made by publishing the two accounts together, they will henceforth appear under the one title shown at the head of Part III. of the East-African Polychæta (*cf.* below, p. 287).

Genus CHÆTOPTERUS.

The species of this genus are difficult to determine on account of the numerous very imperfect descriptions published and the variability common apparently to all the Chætopteridæ. Only the European species has been at all fully described (by Joyeux-Laffuie). His revision of the species is for the above reason confined to a consideration of the variations of the European form and the conclusion that they all belong to one species, *C. variopedatus*. Differences in the number of the segments comprised in the three body-regions are given, but possible variations in other respects, which from a consideration of the numerous exotic species set up may be important, are not worked out.

Marenzeller's description (5) of a *Chætopterus* from Japan does not figure in Joyeux-Laffuie's literature list, nor does the latter work out the differences in the setæ and uncini of different parts of the body as Marenzeller does for his species *C. cautus*. I have followed Marenzeller's method with *C. variopedatus*, and find that his description of the setæ of *C. cautus* serves perfectly for those of *C. variopedatus*, except that the uncini differ slightly in size, in correspondence with the sizes of the worms (*C. cautus* is about 80 mm. long, *C. variopedatus* about 115). The numbers of the

* For explanation of the Plates, see p. 286.

teeth borne by the uncini differ slightly, but are also variable. Uncini from the hind body of *C. variopedatus* which Marenzeller examined bore 11 or 12 teeth, whereas in my specimens of the same species the corresponding uncini, though larger, bear but 8 or 9, variation thus affecting not only the uncini of different parapodia but those of entire individuals.

Slight differences in the form of the long setæ are not a certain distinction between species. Their broad ends are more properly compared to leaves than to spear-heads, for they are thin and flexible and would yield to, not pierce, the surface of the wall of the tube. Their appearance may therefore be altered during examination by pressure and bending.

Only well-marked differences in the setæ are admissible therefore as a specific distinction, and Marenzeller's *C. cautus* would be regarded, so far as the description given is concerned, as a variety of *C. variopedatus* but for its peculiar tube, which has three or four narrow openings at either end, instead of the simple ending of the tube of *C. variopedatus*. As this peculiarity was found in the half-dozen or so specimens examined, I conclude that we have here a true species whose tube only is as yet described.

Joyeux-Laffuie recognises the following exotic species :—

1. *C. afer* Quatref. } Described from tubes alone.
2. *C. australis* Qfg. }
3. *C. capensis* Stimpson.
4. *C. hamatus* Schmarda.
5. *C. macropus* Schm.
6. *C. pergamentaceus* Cuv.

Marenzeller adds to these :—

7. *C. appendiculatus* Grube,
8. *C. luteus* Stimpson,
9. *C. antarcticus* Kbg.,

and remarks that 1, 3, and 4, and 2, 5, and 8 are evidently the same species, and that *C. antarcticus* = *C. variopedatus*, a fact lately verified by Ehlers in the 'Magalhaensischen Sammelreise.' De St. Joseph gives *C. pergamentaceus* as a synonym of *C. variopedatus* *. American authors, however, continue to use the former name.

We obtain thus a much shortened list as follows :—

1. *C. afer-capensis-hamatus.*
2. *C. australis-luteus-macropus.*
3. *C. appendiculatus.*
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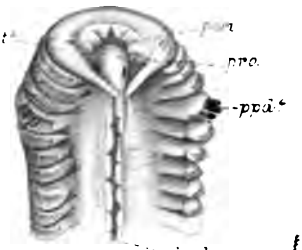
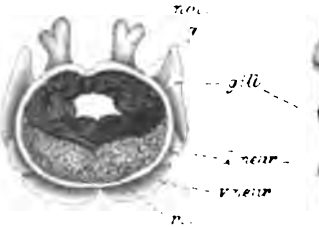
Apparently, in former days, zoologists considered a remote locality a complete justification for describing a specimen as new without any comparison of its structure with that of already known species. For instance, Schmarda describes together

* A recent examination of a specimen from Woods Holl, Mass., U.S.A., gives indications that this may be a distinct variety or species. See note on p. 276.



3 x10.



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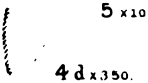


4 d x350.

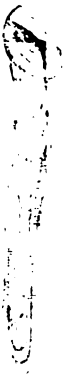
7 x70.

a.

b. c.

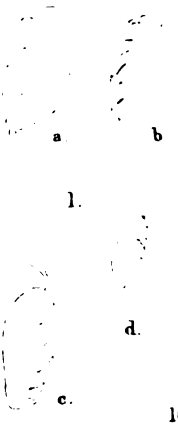
4 x70.

8 x60



9.

2 x70



a b

1.

d.

c.

10 x300

11 x300

C. Crossland del. Huth sc. et imp.

1, 2. CHÆTOPTERUS LONGIPES.
3-7. PHYLLOCHÆTOPTERUS GARDINERI.
8-11. HYALINŒCIA CAMIGUINA.

teeth borne by the uncini differ slightly, but are also variable. Uncini from the hind body of *C. variopedatus* which Marenzeller examined bore 11 or 12 teeth, whereas in my specimens of the same species the corresponding uncini, though larger, bear but 8 or 9, variation thus affecting not only the uncini of different parapodia but those of entire individuals.

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C. hamatus and *C. macropus* without contrasting them in any way, and, indeed, the parts he described in the one species he altogether passed over in his description of the other, and *vice versa*. Such descriptions as are given by this author are so obviously inexact, and his figures without explanations so unintelligible, that the whole can only be ignored. Nos. 1 and 2 are therefore struck off the above-given list.

This circumstantial evidence for the identity of the above-named species with that of European seas has been completed by my examination of a specimen, undoubtedly of the latter species, from the Cape of Good Hope. I owe this opportunity to the kindness of Prof. McIntosh.

Grube's description of *C. appendiculatus* is exceedingly short and without figures. The differences from *C. variopedatus* are (1) only 8 parapodia in the first body-region; (2) the uncini of the tori of the first body-region "are armed with about 20 very short denticles." As Joyeux-Laffuie shows, *C. variopedatus* sometimes has only 8 parapodia in the anterior region, and "about twenty" teeth to the uncinus is too slender a distinction for the creation of a new species. Whether or no *C. appendiculatus* is a synonym of *C. variopedatus* cannot at present be stated.

We conclude, therefore, that the genus *Chætopterus* as at present known contains four species, including the two new species from Gardiner's collection, distributed as follows:—

1. *C. variopedatus*. European seas, the Straits of Magellan, the Antilles, North-American coasts, Cape of Good Hope.
2. *C. cautus*. South of Japan.
3. *C. longimanus*. } The Maldive Archipelago.
4. *C. longipes*. }

In addition are many species partially described, which may or may not be identical with *C. variopedatus* or may be as yet unknown species. The former is the more likely explanation, and in that case *C. variopedatus* has been recorded from almost the whole of the Northern and Southern hemispheres.

CHÆTOPTERUS LONGIMANUS, sp. n. (Plate XVIII. figs. 1, 2.)

With eleven "thoracic" parapodia, of which the 1st is longer than the 2nd and 11th and nearly as long as the longest, the 9th. Hind body short, of about twenty segments. The setæ of the notopodia of this region have flexible ends. Uncini large, dark brown in colour, with few teeth.

Otherwise the species resembles *C. variopedatus*.

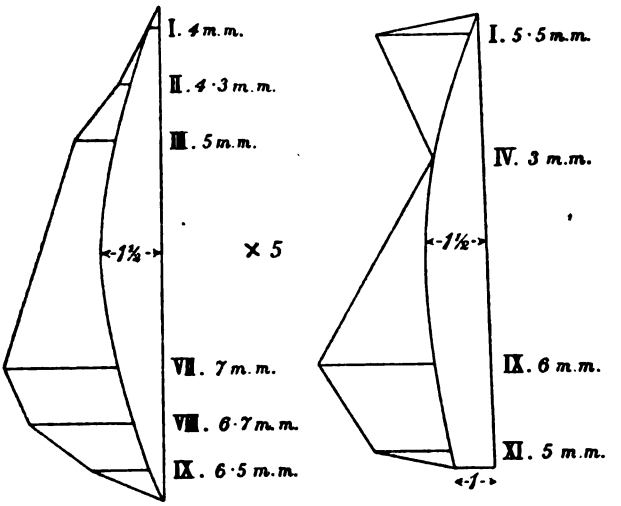
Locality. Suvadiva Atoll, the Maldive Archipelago, 30 fathoms. Rough stony bottom.

The single specimen is a male, sperm-morulæ rendering the hind body and its parapodia an opaque white. It is therefore probably near to its full size, though its total length is but 76 mm. The length is made up thus: A, 15 mm.; B, 24 mm.;

C, 37 mm.* The size of the fore body, exclusive of the parapodia, is nearly that of *C. variopedatus*, viz. 15 mm. × 11 mm., while the total length of the latter species is about 115 mm.

The numbers of segments composing each region are 13, 5, and 22 respectively, the thirteen segments of A bearing eleven parapodia †. The cephalic segments and their eyes and tentacles are exactly as in *C. variopedatus*. The parapodia differ, however, in being longer, and, as they are slender, their length is exaggerated in appearance. In *C. variopedatus* the 1st is the shortest and the 7th (sometimes the 6th) the longest, the 9th or last being a little longer than the 1st. In *C. longimanus*, on the other hand,

Text-fig. 38.



Diagrammatic representation of lengths of parapodia of the body-region A in *C. variopedatus* and *C. longimanus*.

Roman numerals are the numbers of the feet whose lengths are given in mm.

The inner curved lines represent the outline of the side of the body, the outer angular lines the curves made by the tips of the parapodia. Five times the natural size, but the whole length of each parapodium is not drawn, only its excess over that of the shortest being represented by the horizontal lines.

the 1st is almost as long as the longest—the 9th, the 4th being the shortest and the 11th slightly shorter than the 9th. This difference between the two species may be shown graphically by the diagrams of text-fig. 38.

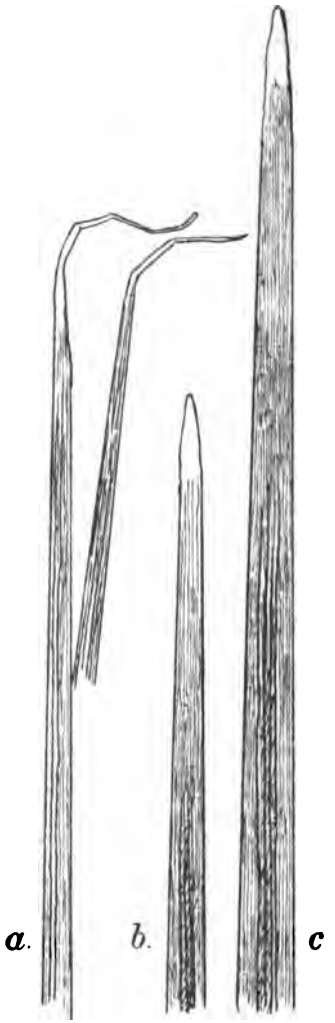
The first parapodium is thus longer than the last, which is

* I follow Joyeux-Laffuie in his definitions of the three body-regions which I designate A, B, and C as being more convenient and better than writing their names in full, and avoiding such terms as "thoracic" and "abdominal."

† This is possible in an extreme variation of *C. variopedatus*, but it is unlikely that the only specimen found in this large collection should be such a rare abnormality.

never the case in *C. variopedatus*, a fact not alluded to by Joyeux-Laffuie, though noted by Marenzeller for his *C. cautus*. The above

Text-fig. 39.



Setæ of hind body of notopodia: *a*, of *C. longimanus*, *b* & *c*, of *C. variopedatus*.

measurements are slightly larger by about 0·5 mm. each than those given for *C. cautus*.

The neuropodium of the last segment of A is a low straight ridge, thus differing from the semicircular flap found in *C. variopedatus*. Each extends about one-third across the body (as in *C. variopedatus*), and its uncini are conspicuous by their brown colour.

The parapodia of the regions B and C are exactly similar to those of *C. variopedatus*.

I have examined in detail the setæ of *C. variopedatus*, but, in preference to repeating what is there stated, refer to Marenzeller's description, which applies equally well to *C. variopedatus* and to *C. cautus*.

In *C. longimanus* the long setæ of A correspond exactly to those of *C. variopedatus*, which differ from those figured by Marenzeller in *C. cautus* only in that the more slender-bladed setæ of the last notopodium are less bent at the junction of the leaf-like expansion and the shaft. This difference, as explained above, is probably accidental. Their shafts are striated longitudinally, and their thin expansions transversely by two sets of fine lines, as described by Marenzeller and Schmarda.

The long setæ of the hind body are more slender than those of *C. variopedatus*, and whereas those of the latter terminate in a definite, more or less blunt point, those of the former have slender flexible prolongations as in text-fig. 39 (p. 274). Though at first sight this flexible ending appears likely to be accidental, I find it to be a constant distinction. It is figured clearly by Schmarda in both his *C. macropus* and *C. hamatus*, though in the text he describes the setæ as hooked. This is not so, the flexibility of the ending causing it usually to be bent in a preparation.

In all three species these setæ are of two kinds (a fact not hitherto noted in *C. variopedatus*): the first sort, with blunt proximal ends, extending from the body into the notopodium; the second, much thinner, with pointed proximal ends which overlap the tips of the first kind, and extend into the very point of the notopodium.

The strong setæ of the fourth segment of A number 16 on each side. They differ *slightly* in shape from those of *C. variopedatus* (see Plate XVIII. fig. 1 *a*, *b*). In both species, however, these setæ differ among themselves. Their number in my specimens of *C. variopedatus* is from 18 to 20, while Joyeux-Laffuie gives 15 as the number most frequently met with*.

The variation of the uncini is as described by Marenzeller in *C. cautus* and as I have found it in *C. variopedatus*. In *C. longimanus* they are remarkably conspicuous owing to their dark colour, except in the ventral halves of the neuropodia of C, where, as in *C. variopedatus*, they are invisible to the unaided eye †.

* It does not seem to have been noticed by earlier authors that the setæ of parapodium 4 A are not merely strengthened but that shafts as well as heads are flattened in *C. variopedatus*, as also in *C. longimanus* and *C. longipes*.

† In Joyeux-Laffuie's monograph it is not stated that uncini occur in the neuropodium of the last segment of A. Marenzeller describes them in *C. cautus* and I find them in *C. variopedatus*. In *C. longimanus* they are visible to the naked eye.

The following table gives the sizes of the uncini in the four species known * :—

	C. variopedatus Crossland.		*C. variopedatus* Marenzeller.	
Position on body.	Size in mm.	No. of free † teeth.	Size in mm.	No. of free † teeth.
1. Last neuropodium of A.	·116×·05 ·110×·046	usually 8, sometimes 6	·111×·048	7
2. 1st neuropodium of B ...	.....	.....	.....	.....
3. Lateral tori of C	·110×·046	7 or 8	·081×·045	7
4. Ventral tori of C	·08×·026	8 or 9	·051×·021	11, rarely 12

	C. longimanus.		*C. longipes.*		*C. cautus* Marenzeller.	
Position on body.	Size in mm.	No. of free † teeth.	Size in mm.	No. of free † teeth.	Size in mm.	No. of free † teeth.
1. Last neuropodium of A.	·131×·06	6 or 7	*Absent.*		·084×·036	6, rarely 7
2. 1st neuropodium of B...	·11×·045	6	·05×·026	4	·084×·036	6, rarely 7
3. Lateral tori of C	·10 ·12 ×·05	6	·046×·024	4 or 5		
4. Ventral tori of C	·06×·025	7 or 8	·032×·012	7	smaller	8, rarely 9 or 10

The deep brown uncini of the last segment of A in *C. longimanus* are thus larger, and the remainder are as large as the corresponding ones of *C. variopedatus* in spite of the smaller size of the body of the former species. The numbers of the teeth are smaller. In 4 of the table above their shape is the same for both

* In the only American specimen I have been able to examine, uncini of lateral tori of C have 10–12 teeth, of ventral tori 15–18. Perhaps this species, *C. pergamentaceus*, may be shown to be distinct when more material is examined.

† Following Marenzeller in leaving out of the reckoning the last rudimentary tooth which may or may not be developed.

Although the uncini of different individuals are variable (*cf.* my measurements and those by Marenzeller), the variations are in all specimens of the four species in the same direction, the sizes in all the columns getting smaller towards the bottom, the numbers of the teeth greater. De St. Joseph, who examined only three specimens, also gives an incomplete list of measurements of uncini, which measurements are all slightly different from my own and those given by Marenzeller.

species, but in 1 and 3 of the table the back of the uncinus is more curved than in *C. variopedatus* (see Pl. XVIII. fig. 2), being thus very like Marenzeller's figure for that of *C. cautus*.

The tube of *C. longimanus* is exactly like that of *C. variopedatus* in its material. Its shape &c. cannot be determined from the fragment available.

CHÆTOPTERUS LONGIPES, sp. n. (Plate XIX. figs. 1, 2.)

Of small size. No neuropodium to the last parapodium of the first body-region. Third body-region of few segments, which bear large and peculiarly shaped notopodia.

Otherwise the species is like *C. variopedatus* in its main lines.

Locality. Fadiffolu, Maldive Archipelago, 15 fathoms. Bottom of coral and stones.

The body-regions are made up as follows:—

A. 3 mm. × 2 mm. (exclusive of parapodia), with 9 parapodia, the fourth pair of which bear stronger setæ.
B. 4 mm. long, with wings, sucker, and 3 fans as usual.
C. 2½ mm. long, with 9 parapodia.

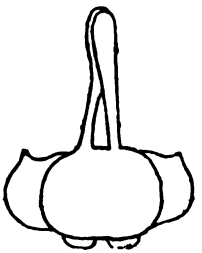
The specimen is, for a *Chætopterus*, very small, being only 9·5 mm. long (exclusive of the last pair of notopodia, which add about 1 mm.), and the shortness of the region C *may* be due to immaturity.

Unfortunately the tube was not obtained.

The cephalic region is as in *C. variopedatus*.

The first and last parapodia of A are very short, being 0·5 and 0·75 millimetre long respectively, the first being thus shorter

Text-fig. 40.



Diagrammatic section of hind body of *C. longipes*, showing proportions of the parapodia.

than the last, as in *C. variopedatus*. They increase regularly in length up to the sixth, which is 2 millimetres long. The last has no trace of a neuropodium, and there is no ridge-like rudiment of the neuropodia of the preceding segments.

The notopodia of the region C are remarkable. They are very

long (up to 2·5 mm. anteriorly), narrow at their bases, and broad distally. In correspondence with this the outer division of the neuropodium is found on the body-wall, not on the basal part of the notopodium as in the other species (text-fig. 40, p. 277). The neuropodial cirri of *C. variopedatus* are not present in *C. longipes*. The notopodia project vertically upwards, each in contact with its fellow above the back, giving this region of the body a striking appearance. The first six are long, but posteriorly they become short and directed in a line with the axis of the body. The ventral halves of the neuropodia are as usual.

The setæ of A resemble closely those of *C. variopedatus*, but are fewer and stouter in proportion. Each notopodium contains about 20, as against 60 in *C. variopedatus*. Their variations in shape and stoutness, in correspondence with their positions, are also as in this latter species. The nine ventral setæ of the fourth notopodium of A are broadened, but remain of a light brown colour. Their ends are of the usual shape, but they are all more strongly striated and roughened than are those of *C. variopedatus* or even of *C. longimanus*, in spite of their very much smaller size (Pl. XIX. fig. 2).

For the description of the uncini I refer to the table given (p. 276) and to the figure 1, Pl. XIX., and its explanation.

PHYLLOCHÆTOPTERUS ACICULIGERUS, sp. n. (Pl. XVIII. figs. 3–7.)

Definition.—Of large size. Gill-region of two (or three) segments only. With eight strong setæ in 4th foot, and numerous slender setæ in the conical notopodia of the third body-region.

Closely allied to P. major *Clap.*

The species is of large size for a member of this genus, being 7 mm. broad. The greater part of the hind body is unfortunately missing. It is thus, at any rate, as large as, if not larger than, *P. major* Clap.

The head is, as usual in Chætopterids, mainly formed by the peristomium, besides which the prostomium, though distinct, is insignificant. Fig. 3, Pl. XVIII., gives its shape and relationships. I do not find eye-spots developed. The peristomial collar is well developed, though low on the dorsal side, and the second smaller pair of tentacles are seen to be continuous with it. The long tentacles are lost. In all Phyllochætopterids they are very readily thrown off, and special precautions are necessary to ensure their preservation.

The region A is 11 millimetres long by 7 broad, including the parapodia, of which there are nine pairs. They are longer and more tapering than in the other species, more like those of the same region in *Chætopterus*. The fourth notopodium contains *eight* thickened setæ of a brown colour, proximally strongly striated but without other markings. This number is very remarkable, *P. gracilis* being the only species formerly known which possesses more than one. No other species has more than three, or,

abnormally, four. Their shape is shown in Pl. XVIII. fig. 4, the end being slightly hollowed out between the two points. The setæ of this region vary considerably in form and strength. The figure (Pl. XVIII. fig. 5) shows the shapes found in the fifth and in the last feet of this region. The majority are like "*a*," but in the fifth foot are found dorsally a few of a more slender kind (*b*). In the last foot most of the setæ are more slender (*c*), and some have narrow and slightly bent heads (*d*).

The region B consists of two * segments, both of which bear the usual type of "gill," which are here proportionately small, directed horizontally and outwards, and flattened against the dorsal surface of the body (Pl. XVIII. fig. 6, *not.*). Each gill consists of a dorsal part, bifid at the tip, and a more laterally placed membranous triangular flap (Pl. XVIII. fig. 6, *gill*). The median half of the bifid notopodium contains about 40 capillary setæ which do not project, this large number being unusual in the genus. The whole gill is delicately membranous, and white in colour, in contrast to the darker (in spirit) glandular and muscular portions of the body. The neuropodial tori are very large and muscular (Pl. XVIII. fig. 6, *neur.d.*), and only in the case of the left neuropodium of the second segment does its characteristic division into a dorsal and a ventral part occur. In this case the two parts lie directly one above the other, as also throughout the region C (Pl. XVIII. fig. 6, *neur.d.* & *neur.v.*); cf. also *P. gardineri* (Pl. XIX. fig. 5) and the other species of the genus.

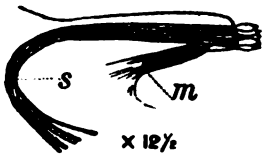
In all the species of this genus the anterior part of the body is very glandular, but not usually conspicuously so beyond the limits of the region A. In this species, however, we have (1) glandular ridges in front of the first gills (Pl. XVIII. fig. 6, *gl.*); (2) from the centre of each semicircular neuropodial torus springs a long glandular cirrus which arches over the back. The second segment appears to be without these glandular appendages, which are, I believe, unique in the genus.

Of the region C only twelve segments are present, but probably they are very numerous, as in *P. major*. In all the species of this genus this region is muscular only on the ventral surface. Dorsally there is but a very delicate membrane between the large cavity of the gut and the exterior, the region being thus of a dense black colour dorsally and laterally, in consequence of the pigmentation of the gut-walls. This very fragile dorsal surface is usually ringed by narrow bands of muscle at each pair of parapodia, but in this species these muscles are scarcely visible externally. The very small notopodia are conical, and contain about nine long, bent setæ (text-fig. 41, p. 280), the leaf-like ends of which project

* As in *P. major* Clap. perhaps a third, gill-less, segment should be reckoned as belonging to this region, but whether Claparède's contentions in favour of so doing apply to *P. aciculigerus* I am unable to say, the worm being broken at this point. The matter is of very small importance in any case, the parapodia of this third segment being like those of the region C in both species.

(Pl. XVIII. fig. 6 and text-fig. 41), the presence of this number being a peculiarity shared only by *P. claparedi*. In all the other species the notopodia of C are, as in *P. gardineri*, clavate papillæ containing a single seta.

Text-fig. 41.



Side view of a notopodium of *Phyllochætopterus aciculigerus*.

s = setæ; *m* = muscle.

The neuropodia are of fair size, though much smaller than those of the gill-bearing region. Their uncini are as shown in Pl. XVIII. fig. 7.

Although the tube is unfortunately missing, the facts of the large size of the worm and that but one specimen was collected make it almost certain that it is straight and occurs singly.

Locality. Mamaduvari, South Mahlos Atoll, the Maldive Archipelago. From the reef.

PHYLLOCHÆTOPTERUS GARDINERI, sp. n. (Plate XIX. figs. 3–7.)

This species is too closely related to *P. elioti* (P. Z. S. 1903, vol. i. p. 172) for a concise definition to be possible. It is readily separable, however, by its much larger size.

The collection contains a single complete and beautifully preserved specimen, but the tube is missing.

The species is of rather larger size than the majority of this genus, measuring 2·5 mm. across the anterior body-region. The head is of the same breadth, or nearly so, as the succeeding segments, the peristomial collar being but slightly developed. The prostomium is large and bears two very distinct eye-spots (Pl. XIX. fig. 3). The region A bears 15 stumpy dorsally-directed parapodia. Their setæ are like those of *Chætopterus*, but their ends, as in the other species of *Phyllochætopterus* examined by me, are thicker and more strongly striated. The fourth notopodium contains three strong light brown setæ, the flattened shape of which (Pl. XIX. fig. 4 *a*) recalls that of the corresponding setæ in *Chætopterus*. These are straight, but some of the ordinary slender setæ of this parapodium are bent (Pl. XIX. fig. 4 *b*). The majority of the setæ of this region are of the usual form, but the last segment carries some which are bent at the head as shown in fig. 4 *c*, Pl. XIX.

The first three segments of the region B are muscular even

dorsally, but the remainder, like all those of the region C, are very delicate dorsally, black, and annulated by the rings of muscle which surround the body at each pair of parapodia, as mentioned above.

This region consists of 24 segments. Its parapodia are proportionally much larger than are those of the former species. The gills are of the usual structure, the lower flap being large and continuous with the ventral part of the neuropodial torus (Pl. XIX. fig. 5, *gill, v.neur.*). The dorsal ramus of the notopodium contains six slender setæ, with delicate club-shaped ends which do not project.

In the first segment of this region the gill-flap is not developed nor is the neuropodial torus divided. In the remaining segments, however, the dorsal part is small and placed in front of and below the upper edge of the ventral part (Pl. XIX. figs. 5 & 6). The uncini, as in the region C, are triangular, with very minute teeth, which are, however, distinctly visible under a $\frac{1}{6}$-inch objective (Pl. XIX. fig. 4 *d*).

The notopodia of the region C are small, projecting vertically from the dorsal surface. Each is a clavate papilla containing one striated seta, the leaf-like head of which half projects (Pl. XIX. fig. 7). The figure is of an optical section, showing the prolongation of the cœlom round the seta, which is covered by the delicate cœlomic epithelium.

As in the case of the preceding species, its size and the fact that but one specimen was collected indicate that it inhabits a straight tube occurring singly.

Locality. Dredged off Minikoi Atoll, the Maldive Archipelago.

Genus Hyalinœcia.

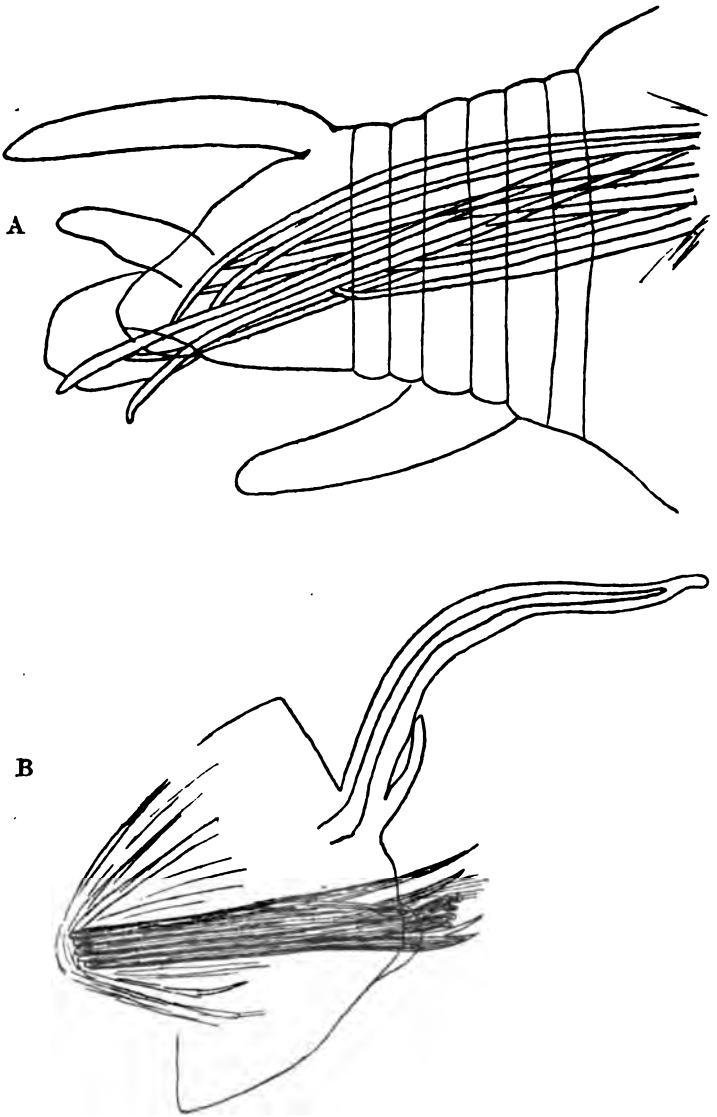
Hyalinœcia camiguina Grube. (Plate XIX. figs. 8–11.)

This species, first described by Grube from Semper's Philippine collections, was dredged from the following localities in the Maldives.

North Malé Atoll ..	27 fath.	Sand, shell, and rubble.	2 large specimens.
,, ,, ...	20 ,,	Broken shells.	2 smaller.
,, ,, ...	25 ,,	Dead coral and sponge.	
S. Nilandu	30 ,,	Hard.	5 large.
,, ...	36 ,,	Hard sand.	Numerous, small.
Kolumadulu	35 ,,	Weed and sand.	2 large, 2 small.
Mahlos	20 ,,	Sand and rubble.	1 large.
Felidu	25 ,,	Coral rubble.	1 large.
Fadiffolu	22 ,,	Weed, sand, and stones.	5 large.
Miladumadulu	28 ,,	.....	1 large and 1 small.

The smallest tubes measure 3 cm. × 0·15 cm., the largest 4·5 cm. × 0·25 cm. They are slightly curved and a little thinner

Text-fig. 42.



A.—First (and modified) foot of *Hyalinœcia camiguina*, shewing ringing, modifications of setæ and seta-sac, lip, &c. × 55.

B.—A foot of *Hyalinœcia camiguina*, from about the middle of the body. × 55.

at that end to which the worm's head is directed. Their resemblance to quills is increased by the presence of delicate membranous rings inside at intervals.

Grube's figures give the general appearance of the body, though the peristomial segment is not, in these specimens, so inconspicuous, nor do the palps show themselves anteriorly below the frontal tentacles. His figure of the dental apparatus is not quite accurate, especially in the peculiar bending of the mandibular forceps. The figure (Pl. XIX. fig. 8) gives their shape, which is that usual in this group. The darker shading indicates the restriction of brown chitin to small portions, the main mass of the plates being calcareous. The end-plates of the lower jaws are in young specimens a regular oval, in the older notched as in Pl. XIX. fig. 9, and later the two distal points become still more prominent.

The modifications of the feet and setæ are those typical of this group and genus (see text-fig. 42), the only features characteristic of the species being (*a*) the acicular setæ, whose ends curiously resemble a miniature machinist's key; (*b*) the comb-setæ, whose teeth are shortened and rounded as shown in fig. 10, Pl. XIX. This appearance is not due to wear, being found invariably in all the numerous combs of both anterior and posterior feet.

Pl. XIX. fig. 11 represents three of the special setæ of the first three parapodia. Only one of the three shows the characteristic "incomplete articulation," and hoods over the hooked points may or may not be present.

The dorsal cirrus is well developed until the gill-region is reached, when it somewhat suddenly decreases in size (*cf.* text-fig. 42, A & B).

Genus Onuphis.

Onuphis holobranchiata Marenzeller *.

Three well-preserved but very small specimens (1 mm. wide) were collected (1) by breaking up stones on the reef of Minikoi Atoll; (2) from 5–7 fathoms in the southern part of the lagoon of the same atoll; (3) dredged off Mahlos Atoll, from 23 fathoms, bottom rubble and sand. This distribution, from shore to 20 fathoms, coincides with that found in East Africa.

The hind end of all the specimens is wanting, as is the case in all others hitherto collected.

These specimens are now colourless, and so show the small reddish eyes in the lateral position given by Marenzeller, which are hidden by the general body pigmentation in the African specimens.

The gills here begin on the first segment, as is normal in the species.

* "Südjapanische Anneliden," Denkschr. k. Akad. d. Wiss. Wien, xli. (1879).

As in all previous collections the tube was not obtained, an interesting fact seeing that the modifications for the tubicolous habit are as well marked here as in any species of this group.

It is remarkable that this widely-ranging species, occurring as it does between tide-marks and down to 23 fathoms, should be absent from Semper's Philippine and from the 'Challenger' collections. Since its collection in the south of Japan in 1876 I find no mention of its occurrence until Gardiner brought it from the Maldives in 1900 and I from East Africa in 1902.

Lately Prof. McIntosh has published an account of a form from 70–200 fathoms off the Canadian coasts, which he doubtfully identifies with this species*, hinting that further researches may prove its identity with *O. grubei* Marenz. and *Nothria tenuisetis* McI.†

Genus Lysidice.

Lysidice collaris Gr.

This very widely distributed form is here represented by only two specimens, one from the reef of Manadu Atoll, the other dredged from 25 fathoms, bottom hard rock, off S. Nilandu Atoll. Both specimens are of a fair size.

Ehlers remarks on the possibility that the *L. collaris* of the Indian Ocean may be the same as the Mediterranean species of this genus. A comparison of all available Indian Ocean specimens‡ with four European § of *Lysidice ninetta* shows that the species are certainly very closely allied.

The proportions and form of the body are the same exactly, viz. of nearly uniform diameter from the head onwards and flat below, strongly arched above.

I am indebted to Prof. McIntosh for the following description of the colour of *L. ninetta* when alive. It is strikingly like that characteristic of the Indian Ocean form ||:—

"Head is pale brownish, dappled with pale dots, the nuchal border being rather darker. The first three segments are tinted of a deeper brown hue than the rest of the body and dappled with pale spots. The fourth segment is pale anteriorly, and this makes a contrast with the preceding. In some the posterior border of this segment is brownish and speckled with white dots, in others it is white as is also half the succeeding (*Ehlers*). A specimen trawled off Sark had only a white patch between the eyes instead of the usual white belt on the 5th segment. The coloration

* Annals & Mag. Nat. Hist. ser. 7, vol. xii. 1903, p. 152.

† 'Challenger,' vol. xii.

‡ Viz. the above Maldivan, five from East Africa, one brought from the Seychelles by Dr. E. P. Wright.

§ Two large specimens given to me by Prof. McIntosh and collected by him between tide-marks in Guernsey and two small ones purchased from Naples.

|| Crossland, "The Marine Fauna of Zanzibar," P. Z. S. 1903, vol. i. p. 169.

indicated (brownish with pale dots) stretches to the 20th or 25th segment and fades into the general brownish iridescence of the body."

The prostomium is of characteristic shape and size in both, but a constant difference is found in the median notch of its anterior border, which is much less deep in *L. ninetta*. In that species the short cone-shaped tentacles do not reach its anterior border, while those of *L. collaris* which are more gently tapered extend a little beyond it, and the characteristic crescentic or kidney-shaped eyes of the Indian Ocean form are replaced by round or oval ones in that of the Mediterranean and Channel.

The dental apparatus and especially the very characteristic plates of the lower jaw form a striking feature common to both species. The feet and setæ also afford no distinction, as though the articulated pieces of the compound setæ appear a little longer in the European form, this feature varies widely in specimens from the Indian Ocean.

List of Literature.

Genus *Chætopterus*.

(1) Schmarda.—'Neue wirbellose Thiere.' 1861.
(2) Jourdain.—Mém. de la Soc. nat. des Sci. nat. de Cherbourg, xi. pp. 76–80 (1865).
(3) Lespès.—"Étude anatomique sur un Chétoptère" (*C. brevis*). Ann. Sci. Nat. (5) xv. 1874, Art. 14.
(4) Grube.—Proc. Roy. Soc. 1874, p. 325.
Grube.—"Annulata Semperiana." Mém. de l'Acad. Imp. de St. Pétersbourg, viie série, t. xxv. no. 8.
(5) Marenzeller.—"Südjapanische Anneliden." Denkschr. d. k. Akad. der Wissenschaften, Mathem.-naturwiss. Classe, Bd. xli. (1879).
(6) Joyeux-Laffuie.—"Monographie du Chétoptère." Arch. Zool. exp. et gén. 1890.
(7) Ehlers.—'Hamburger Magalhaensischen Sammelreise.'
(8) De St. Joseph.—"Annélides Polychétés des Côtes de Dinard." Ann. Sci. Nat. 8e sér. t. xvii. (1894).

Genus *Phyllochætopterus*.

(1) Claparède.—'Annélides du Golfe de Naples.' 1868.
(2) Langerhans.—"Ueber einige Canarischen Anneliden." Nov. Act. der Leop.-Carol. Deutsche Akad., Bd. xliii. (1881).
(3) McIntosh.—'Challenger' Reports, vol. xii. 1885, p. 374.
(4) Roule.—"Campagne du 'Caudan'." Ann. de l'Univ. de Lyon, 1896.
(5) Lo Bianco.—Ann. Pub. nel Golfo di Napoli. 1892.

EXPLANATION OF THE PLATES.

For lettering, see below.

Plate XVIII.

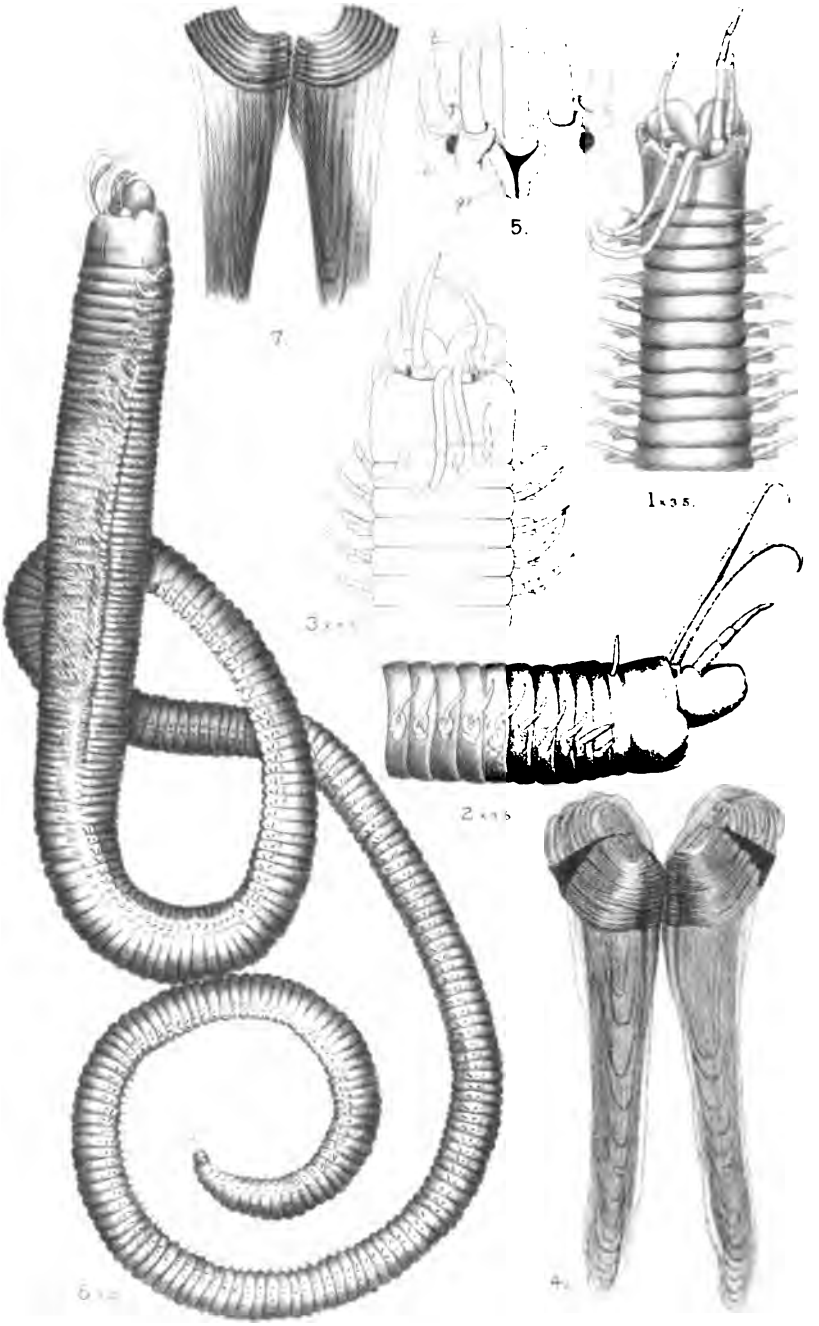
Fig. 1. *Chætopterus longimanus* (p. 272). Two of the thickened and flattened setæ of the 4th foot, showing the extreme forms met with in the same bundle. × 70.
2. Uncini (*a*) from inner half of neuropodial torus of C; (*b*) from outer half of the same; (*c*) from the neuropodial torus of last foot of A. All × 350.
3. *Phyllochætopterus aciculigerus* (p. 278). Dorsal view of head and fore part of body. The long tentacles are lost. × 10.
4. The point of one of the acicula from the 4th foot. × 70.
5. Setæ of the region A:—*a* & *b* from the 5th foot; *c* & *d* from the last. × 70. *a* is the normal form in the 5th foot, but dorsally are a few like *b*. In the last foot most are like *c*, others like *d*, and a few like *a*.
6. The mid-body (region B) together with adjoining segments of A & C. × 10.
7. An uncinus from the ventral division of the fifth neuropodium of C. × 350.

Plate XIX.

Fig. 1. *Chætopterus longipes* (p. 277). Uncini from various feet:—*a* & *b* two uncini situated near together on the first neuropodial torus of B; *c* from an outer and *d* from an inner torus of C. × 350.
2. Strong setæ from the 4th foot of A. × 70.
3. *Phyllochætopterus gardineri* (p. 280). Dorsal view of head and anterior segments. The specimen is a little contracted. × 10.
4. Various setæ:—*a*, from the 4th foot of A; *b*, a bent seta from the same; *c*, from the last foot of A; *d*, an uncinus from the first neuropodium of B. *a*, *b*, & *c*, × 70; *d*, × 350.
5. Drawing of an excised segment of the region B, as seen from in front, showing parapodial gills, black gut, epithelium, &c. × 10.
6. Ventral view of three segments of mid-body, showing relative positions and sizes of the parts of the neuropodia. × 10.
7. One of the clavate notopodia of the region C as seen in optical longitudinal section. × 70.
8. *Hyalinœcia camiguina* (p. 281). Upper jaw-plates. The darker shading represents brown chitin, the lighter calcareous matter. × 60.
9. One of the lower jaw-plates of a larger specimen. × 60.
10. Group of four kinds of setæ, from a parapodium near the hind end of the worm. (The combs are often much more numerous.)
11. Group of special setæ *in situ* from the 2nd foot. × 320.

Explanation of the lettering.

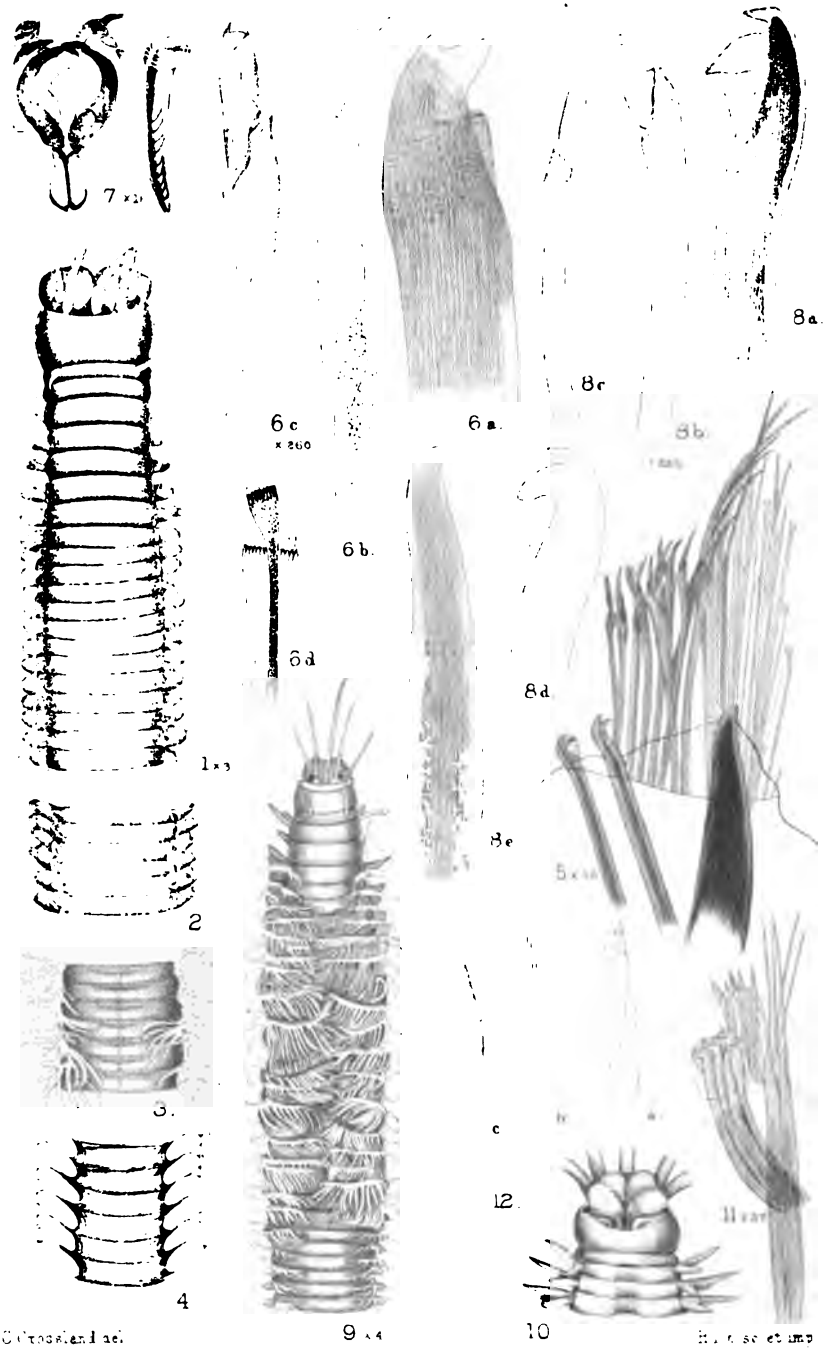
cœ. = cœlom.
d.cil. = dorsal ciliated groove.
g. = gut.
gill. = triangular membranous flap between the noto- and neuropodia.
gl. = glandular apparatus adjoining the gills.
m. = muscle.
neur.d. = } dorsal and ventral parts of the neuropodia.
neur.v. = }
not. = notopodium.
peri. = peristomial collar.
pro. = prostomium.
$ppd._4$ = fourth parapodium.
s. = seta.
$t._2$ = second pair of tentacles.



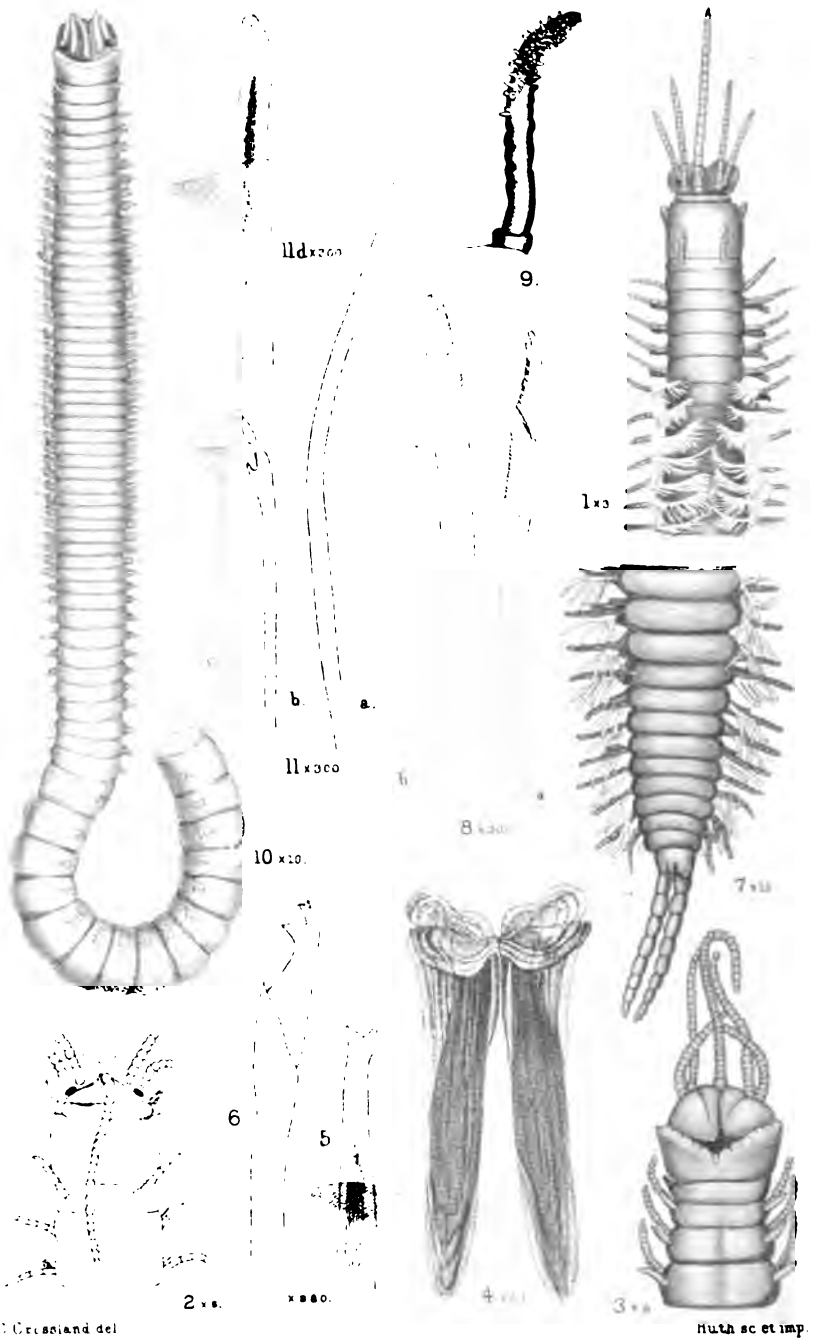
G. T. Bagstaff del

Huth sc et imp

1–5. EUNICE AFRA.
6,7. E. COCCINEA.



1-6 EUNICE TUBIFEX, full grown.
7,8 E. TUBIFEX, young. 9-12 E. INDICA.



J. Greenland del
Huth sc et imp.

1-7 EUNICE ANTENNATA. 8,9 E. SICILIENSIS
10,11 NICIDION GRACILIS.

4. The Marine Fauna of Zanzibar and British East Africa, from Collections made by Cyril Crossland in the Years 1901 and 1902.—The Polychæta. Part III.* With which is incorporated the Account of Stanley Gardiner's Collection made in the Maldive Archipelago in the Year 1899.

By CYRIL CROSSLAND, B.A., B.Sc., F.Z.S., the Gatty Laboratory, St. Andrews.

[Received December 15, 1903.]

(Plates XX.–XXII.† and Text-figures 43–66.)

Genus EUNICE.

The species fall into the following groups, of which A contains the greater part of the genus:—

A. Generalised species with tentacles of moderate length, jaws of normal form and constitution, gills well developed in the adult, and setæ of the usual kinds.
  a. Gills continue to hind end of the body.
    1. Gills begin about feet 3 to 8, complex but small in proportion to size of body.
      a. Quadripartite prostomium, gills of up to 30 filaments, and characteristic setæ ... *E. aphroditois*, p. 288.
      b. Bifid prostomium, gills of about 8 filaments, and setæ of quite general form. *E. grubei*, p. 288.
    2. Gills begin between feet 15 and 20, attain to from 4 to 10 filaments anteriorly but are simpler posteriorly. Setæ of general form ... *E. afra*, p. 289.
  β. Gills occur only on the anterior third of the body.
    1. Begin about 6th to 9th feet. Body-form characteristic ... *E. coccinea*, p. 297.

B. Forming tubes of characteristic structure and material. Otherwise very like members of group A.
  1. Compound setæ with sword-shaped articulated pieces anteriorly, sickle-shaped posteriorly ... *E. tubifex*, p. 303.
  2. All compound setæ of the latter form ... *E. floridana* & *E. tibiana*, *E. conglomerans* § & *E. gunneri* (= *amphiheliæ*, &c.).

(These are the remaining species of the group.)

C. With long tentacles, large gills beginning before the 10th foot, three-hooked acicular setæ, and markedly asymmetrical jaws.
  a. Head nearly as broad as the rest of the body, tentacles deeply annulated, jaws strong and chitinous.
    1. Gills confined to anterior part of the body ... *E. murrayi*, p. 310.
    2. Gills continued to near anus ... *E. antennata*, p. 312.

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* For Part I., see P. Z. S. 1903, vol. i. p. 169; Part II., 1903, vol. ii. p. 129.

† For explanation of the Plates, see p. 330.

‡ It is not suggested that this grouping is necessarily of more than temporary utility, but it is certain that in a natural system the larger groups cannot be separated by one character alone, as has hitherto been attempted. Reasons for laying less emphasis upon characters employed for the major divisions by earlier workers are given among the notes on variation of the species described below.

§ These three species are from Ehlers' 'Florida Anneliden,' 1887. *E. conglomerans* is very near to *E. tubifex*, and is distinguished from all other Eunicids by its compound setæ.

β. Head small, tentacles smooth, jaws delicate and calcareous ..... *E. indica*, p. 318.

The remaining species of this group are *E. vittata* *, *E. ornata* †, *E. rubra* ‡.

D. Body of characteristic form, bearing gills of one filament posteriorly; jaw-apparatus highly specialised. Comb and acicular setæ absent ... *E. siciliensis*, p. 323.

In the absence of a complete account of *E. schizobranchia* Clp., this species (including *E. leucodon* Ehl. as a variety, see below) is the only member of the division.

E. Of generalised structure but gills absent.

1. Jaw-apparatus of normal form ..... *Nicidion gracilis*, sp. n., and others, p. 327.

2. Jaw-apparatus somewhat resembling that of *E. siciliensis* ..... *N. edentulum* Ehl., p. 326.

N. balfouriana McI. (as E. 1) and *N. brevis* Ehl. (loc. cit.) are the remaining species certainly known.

EUNICE APHRODITOIS Pallas.

Eunice aphroditois McIntosh, 'Challenger,' xii. p. 282; Gravier, Nouv. Arch. du Mus. Paris, 1900, p. 224.

A single specimen, the posterior end of which is in process of regeneration, from Goidu Reef, Maldives. The body is of very nearly the same width throughout, viz. 2 cm. inclusive of parapodia and setæ.

It should be noted that in spite of the large number of their branches the gills are quite small, not covering any appreciable part of the dorsal surface of the body. The articulated piece of the compound setæ has been nearly always lost, but when present it bears two hooks, and, like the acicular seta, corresponds exactly with McIntosh's figures from the Australian specimen obtained by the 'Challenger.' The dorsal bundle of setæ corresponds with Gravier's account in the disproportionately small number and the long slender points of the capillary setæ, and in the number, characteristic shape, and granular surface of the combs. Since these two points were not given by McIntosh, and small variations of the jaw-plates are not of systematic importance, the only certain foundation for Gravier's var. *djiboutiensis* is the third very small tooth found between the longer two of the articulated pieces of the compound and acicular setæ. This difference is hardly sufficient to warrant the addition of a third name, especially in view of the variation in the shape of these teeth noted in the 'Challenger' specimens.

EUNICE GRUBEI Gravier. .....

Eunice grubei Gravier, Nouv. Arch. du Mus. de Paris, 1900, p. 258.

Only three fragmentary specimens occur—two, small, 3 mm.

* = *E. limosa* Ehlers, Borstenwürmer.

† Andrew, P. U.S. Nat. Mus. xiv. 1891, p. 277. "Annelids of N. Carolina."

‡ Ehlers, 'Florida Anneliden.' Results of dredging by U.S. Survey steamer 'Blake,' 1887.

wide, from 10 fathoms in Wasin Harbour, East Africa; and one, larger, 6 mm. wide, dredged off N. Male Atoll, Maldives, from 35 fathoms, bottom sand.

This species is nearly related to the two following, but is readily distinguished from *E. afra* by the early commencement of the gills, and from *E. coccinea* by their persistence to the end of the body.

The specimens correspond very closely and in detail with the account given by Gravier.

The body is flat anteriorly, immediately behind the buccal segment, though arched dorsally behind. The shortness of the segments immediately following the head is also a feature of note.

In the smaller specimens the annulation of the tentacles is not so easily seen as in the larger. These also differ in the jaw-apparatus, which in the younger are delicate and calcareous, in the adult dark brown. The ends of the lower plates, however, remain white, thus, as in their shape, exactly resembling those of *E. flaccida*.

The forms of the other plates call for no remark, and the following are the formulæ of their teeth:—6—7 : 6+8—8 and 5—5 : 7+7—9; the latter corresponding closely with that given by Gravier.

The gills usually begin at the third foot, but in the two East-African specimens rather later, viz. at the seventh or eighth.

It is impossible not to regard with great doubt the distinction drawn by Gravier between this species and Grube's *E. longicirris* from Suez. The annulation of the appendages varies in distinctness in these specimens, in the largest of which it can be made out in the anterior dorsal cirri as in Grube's species. The length of the tentacular cirri, which in Grube's specimen reach to the anterior border of the prostomium, may be abnormally great, though in one of these the cirri reach well beyond the anterior border of the buccal segment. When a complete specimen is examined it is seen to be true for these, as for Grube's example, that most of the gills reach scarcely half the length of the dorsal cirrus. The larger anterior ones anteriorly are of about the same length, which, allowing for a reasonable amount of variation, corresponds with both Grube's and Gravier's accounts.

However, the brevity of the latter gives enough uncertainty to justify the creation of a new name for these specimens, until Grube's work can be verified and completed.

EUNICE AFRA Peters. (Plate XX. figs. 1–5.)

Eunice collaris Grube, Annulata Semperiana; Gravier, Nouv. Arch. du Mus. de Paris, 1900, p. 251.

Eunice perrieri Gravier, loc. cit. p. 232.

Eunice mutabilis Gravier, loc. cit. p. 245.

For other synonymy see Ehlers, Nachr. zu Gött. 1897 *.

This species, among the least specialised of the genus, besides

* In a note on this species just received, Dr. A. Willey gives *E. paupera* Gr. as yet another synonym.

being of very wide geographical distribution, adapts itself to a varied habitat.

In East Africa the specimens were collected as follows:—

Two large examples 280 mm. × 10 mm. over all, from the interstices of coral, low spring-tide level, Chumbe Island, Zanzibar Channel.

Nine, mostly of similar size, from the sand of Chuaka Bay, Zanzibar.

One, 170 mm. × 4 mm., from muddy sand, lowest tide-level, Prison Island, Zanzibar Channel.

One, incomplete but apparently originally of the same size, dredged from 10 fathoms, Wasin Harbour.

In the Maldives:—

Two of fair size and two smaller, with fragments, from the reef at Hulule, Male Atoll.

Half a dozen small specimens and fragments of a larger from breaking up stones on Minikoi reef, six fair-sized from the lagoon sand, one from decaying beach-sandstone, and three dredged from 5–7 fathoms in the southern parts of the lagoon of the same atoll.

Fragments, in some cases doubtfully identified, from Goidu reef, off Mahlos Atoll, in 4 fathoms and 22 fathoms, the latter from among *Polytrema* and stones; from 30 fathoms with a rough stony bottom off Suvadiva; and on Minikoi reef specimens were found in sand under boulders.

From Funafuti (collected by Gardiner):—Two specimens, one from the outer reef, the other from the mangrove-swamp.

From the Seychelles (collected by Dr. E. P. Wright, of Dublin, in 1868. The specimens were kindly lent to me by Prof. McIntosh):—Two specimens of good size, 6 mm. and 4 mm. wide.

The species is thus recorded from almost every part of the Indo-Pacific area, from the Red Sea to the Philippines, and occurs in almost every kind of habitat.

The examination of this large number leads to some modification of former accounts which were based on one or two specimens only.

The colour of the living animals is somewhat variable, the round or oval white spots and the collar on the fourth setigerous segment (the origin of Grube's name "*collaris*") being often absent or but partially and irregularly developed. The two specimens collected together on Chumbe Island differ in this respect from each other, and form the above arrangement which has hitherto been regarded as specific. The ground-colour of both is a light yellow-brown, interrupted in the one case by uniformly scattered minute white dots alone, in the other irregular transverse blotches of white are added. In neither is there any collar. The tentacles are banded alternately with brown and white, and the feet &c. are white. The specimen from Wasin is similar, but the white blotches are

more clearly marked, and on (setigerous) segments three and four entirely displace the brown pigment, thus forming a very conspicuous collar. An irregular, broad, longitudinal band extends from the base of the median tentacle to the posterior border of the first setigerous segment. The tentacles, nuchal and dorsal cirri, feet, and ventral surface are white or nearly so.

The Chuaka specimens were described in my notes as having a colour resembling that of cocoa, with small irregular marks of a yellowish white. The tentacles are banded with white, and the feet &c. are whitish as above.

The above contrast more or less markedly with the appearance of the single smaller specimen from Prison Island. This had a dark red-brown ground-colour, approaching that of chocolate, which throws up vividly the white spots, which are here somewhat larger and more definite in outline than in most specimens, and the collar, which occupies segment five. The parapodia and their appendages, the tentacles and the edges of the palps are yellowish white. Gills bright red as usual. A white mark encircles the base of the middle tentacle and thence extends to the back of the prostomium.

According to Peters, the original example of the species, like those examined by Ehlers, was devoid of markings.

So far, then, from the collar being a principal distinction of this species, it is more often absent than present*.

In all cases the colour dies out posteriorly or is retained only in the intersegmental grooves.

In the Maldive specimens the pigmentation cannot be certainly made out. A fragment of a specimen of this species has been observed to emit a strong blue phosphorescence at night.

The general appearance and proportions of the body, which are very approximately constant and fairly characteristic of the species, have not yet been described in detail. The nearly cylindrical anterior end is but slightly narrower than the broadest part of the anterior half of the body, the position of which is from about the eighth to the twelfth setigerous segments†. Further back still, near its middle, the body expands again, becoming slightly broader yet (see text-fig. 43, p. 292, and its explanation).

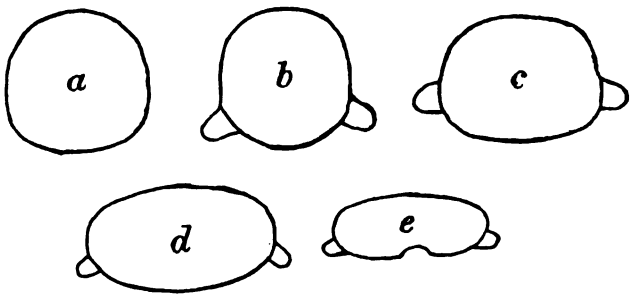
The segments immediately following the buccal are not markedly longer than those composing the rest of the anterior third of the body (Pl. XX. figs. 1 & 2). The first four or five parapodia are rather ventrally placed, so that a narrow, flat surface is enclosed between them, and the body is strongly arched dorsally (see side view of anterior end, Pl. XX. fig. 2) at about the twelfth segment, the parapodia are completely lateral, and the ventral surface becomes more, the dorsal less arched. Further back still both surfaces become nearly flat, the body sometimes being quite

* It is often absent also in *Lysidice collaris*, as noted above, and in *Eunice fasciata*. Ehlers, Nachr. zu Gött. 1897.

† In all cases "*setigerous* segment" is meant, a method of reckoning free from ambiguity.

ribbon-like throughout the posterior two-thirds of its length. Text-fig. 43 represents sections of the body, drawn to scale and illustrating these changes of shape.

Text-fig. 43.



Series of sections of the body of *E. afra*, drawn to scale to illustrate the changes of shape in passing from the anterior to the posterior end.

a. Section of buccal segment.
b. „ of fourth setigerous segment.
c. „ at beginning of gill-region, *i. e.* segment 22.
d. „ at the middle of the body.
e. „ about 2 inches before the anus.

Prepared from a good-sized specimen from Chuaka.

Gravier's figure of the prostomium and anterior end of the body is apparently from an abnormally contracted specimen. The two lobes of the former always diverge more, the peristomium is longer and less swollen, and the tentacular cirri do not take so remarkably lateral a position (compare figs. 1, 2, & 3, Pl. XX.).

According to Grube's tables* this species belongs to that subdivision of the genus characterised by the possession of tentacles devoid of jointing; but Gravier, while quoting this without comment, figures indications of ringing. The fact is that though in most specimens the tentacles appear smooth at first sight, more or less ringing is sometimes quite obvious† and can always be made out with care. The middle unpaired tentacle, which is from three to four times the length of the prostomium, is considerably longer than the other four, which are of about the same length. Too great reliance on Grube's tables in this matter and in the size of the gills leads to the separation of these specimens into two or three species, as was done by Gravier, the validity of whose species will be considered later.

The jaws (text-fig. 44, p. 293) show no characteristic feature, and

* Grube, Mitth. über die Familie der Euniceen.

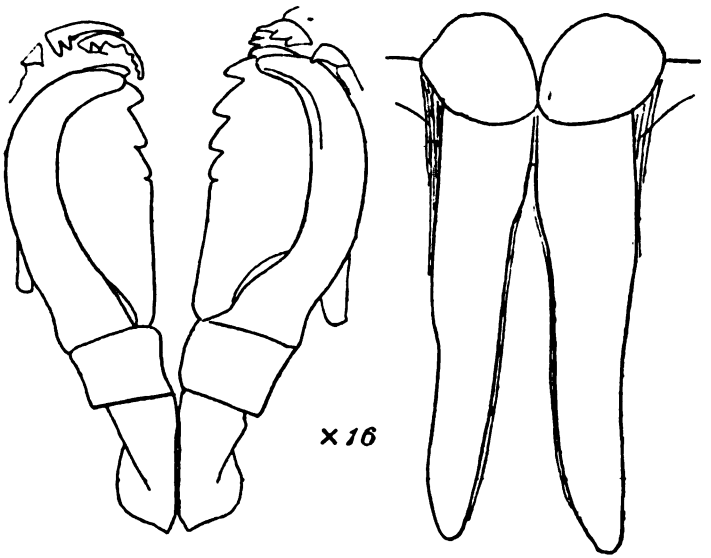
† In *e. g.* two of the nine Chuaka specimens, and the Prison Island and Wasin examples. It is clear too in one of those from the Seychelles, but not in the other.

further vary considerably in the numbers of the teeth they bear, as evidenced by the following formulæ * :—

(1)	4—5.	7+4—8.
(2)	6—7.	7+6—9.
(3)	4—5.	6+4—7.
(4)	4—5.	8+5—9.
(5)	4—4.	7+6—11.

The widely different formulæ (2) and (3) are both from the set of specimens collected at Chuaka.

Text-fig. 44.



Jaws of *E. afra*, from a large specimen from Chuaka. In such every part is black or dark brown, except a narrow border to the lower jaws. The end-plates of the lower jaws are partly calcareous. Contrast the same in a young specimen, as shown in Pl. XX. fig. 4, and compare the latter with Pl. XX. fig. 7, which represents these parts in *E. coccinea*.

The lower jaws bear oval calcareous end-plates whose cutting-edges are almost always entire (Pl. XX. fig. 4 and its explanation). The general shape of the various pieces, as shown by text-fig. 44, is constant.

The feet are well developed throughout the body, and all bear gills except the first fifteen to twenty and those of the last few reduced segments. These attain their maximum development only in the anterior third of the branchiferous region, where, in the Maldivan specimens, they are composed of the usual numbers of

* See Grube, *loc. cit.* p. 19.

filaments, viz. four to six. In the larger specimens from East Africa the number may rise as high as ten, though in no case are the gills large enough to meet over the back. Posteriorly, over the greater part of the body the gills, though remaining of nearly the same length, are simpler, being usually composed of two or three filaments only.

In the very small specimens from the Maldives the gills are proportionately small, their degree of development depending roughly upon the size of the worm. Thus the smallest, which is incomplete and but 1 mm. broad, has only two pairs of gills of three filaments, the others anteriorly being of two and posteriorly of only one. Those of 2 mm. broad have gills of three or two filaments anteriorly and of one posteriorly, while two of the four which are 3 mm. broad attain to gills of four filaments in the anterior part of the body.

The remaining Maldivan specimens are too uniform to afford further evidence of this dependence. The following table describes those from East Africa:—

Locality of specimen.	Breadth of specimen.	Commencement of the gills.	Maximum no. of filaments.	Reduced posteriorly to
Chumbe	10 mm.	Segment no. 20	8	—
„	„	22	10	5
Chuaka	„	19—21	7—8	6
Seychelles ...	6 mm.	17	8	4—3
„	4 mm.	8	5	2
Prison Island .	4 mm.	15	4	3—1

There is here seen to be variation between specimens of the same size, though, on the whole, gill complexity is correlated with increase of the size of the body, a conclusion corroborated by a comparison of the earlier descriptions of this species. The second Seychelles specimen is distinctly abnormal in the early commencement of the gills, but this may be connected with the fact that whereas in other specimens these attain their full size three or four segments after their commencement, in this case the increase is more gradual.

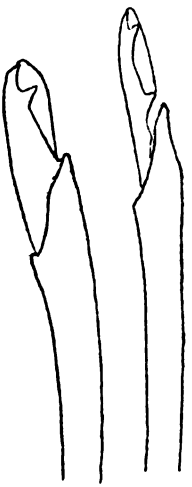
This variation is a great deal wider than is that commented upon by Ehlers when comparing certain specimens from East Africa with these originally named by Peters*. To explain the fact that some specimens have gills of four filaments while others attain to six, he propounds the theory that the species is sexually dimorphic in respect to its gills. It is easy to imagine *a priori* reasons for such a dimorphism, but so far as this account is concerned the grounds for the assertion are of the slightest, and I

* Ehlers, Nachr. zu Gött. 1897.

am assured by Prof. McIntosh that the case of *E. norvegica* adduced as a parallel is quite unproved. The collection of nine specimens together, *all* of which have large gills, makes the theory so unlikely that it has not been thought worth while to resort to microscopic examination to determine that all are of the female sex. The correlation of gill-complexity with body size noted above, mentioned by Gravier for his *E. perrieri* and common to most species of the genus, affords a sufficient explanation without the need of any special theory.

The compound setæ vary in the shape of the articulated pieces, which may be almost that of an equilateral triangle or, as is more usual, somewhat elongated. Text-fig. 45 gives the extremes of this variation.

Text-fig. 45.



× 350

The extremes of forms of the compound setæ of *E. afra*, from specimens from Funafuti and from Hulule, Male Atoll. × 350.

It is well known that differences in the shape are usual between the setæ of anterior and of posterior feet, but such extremes as are here figured are never met with on the same worm. Of *E. afra* nine specimens were specially examined in this respect. Of these two showed a distinct difference in the breadth of the end piece of the compound setæ of anterior and posterior feet, in the other seven no variation in those of the same individual was noticeable. We have to deal with a second variation of a distinct kind, between individuals rather than between the metameric parts of the same worm. Of fifteen specimens examined in detail, eight have setæ which approximate to the elongated type, four those which are

broad, two are rather less elongated, and one is somewhat less broad. The acicular setæ project more or less and so are subject to wear in use, as a result of which the hooks and guard are not often found perfect (when they correspond exactly with Gravier's figure) but usually more or less damaged. The larger and posterior hook being the most exposed is seen to wear away the faster, so that in many cases where attrition has gone furthest, the remnants of both hooks are of nearly the same size, the whole then resembling Gravier's figure of this seta in *E. mutabilis*.

A consideration of the range of variability set forth above enables us to estimate the grounds for regarding Gravier's two species, *mutabilis* and *perrieri*, as synonymous with *afra* Peters (*collaris* Grube).

The former (*l. c.* p. 245) differs from the examples regarded as typical in its uniform pigmentation, the position of the eyes, and the complexity of the gills.

The eyes are placed on the swollen bases of the median pair of tentacles, a condition found frequently in these specimens of *E. afra* (Pl. XX. fig. 5). (From Gravier's text and an examination of the present examples, it is evident that this appearance is exaggerated in the fig. *l. c.* pl. xiii. fig. 71.)

The gills are unusually complex for a specimen of this size, but agree in size and distribution with the above. The setæ figured for *E. mutabilis* differ slightly from those given for *E. collaris* (*cf.* figs. on pp. 247 & 253 *l. c.*), but, as explained above, such variations are common in this as in other species of the Eunicidæ. The jaw-apparatus calls for no remark, its formula being 4—4 : 4+3—5. In his description of the buccal segment of both *E. mutabilis* and *E. perrieri*, but not in that of *E. collaris* (= *afra*), Gravier mentions a projecting lobe laterally, which is present also in all the specimens here dealt with and seems rather characteristic of the species. For its appearance and proportions see the side view of the head figured, Pl. XX. fig. 2.

As regards the supposed new species *E. perrieri*, the arrangement of the pigment in a mosaic so frequently met with is sometimes artificial and due to the wrinkling of the skin, and a similar coloration of the tentacles (the distal part being uniformly pigmented, not banded) is common, though not the rule.

The groove behind the middle tentacle, described here but not mentioned in the cases of *E. mutabilis* or *E. collaris*, and figured by Gravier on pl. xii. fig. 58, is more or less distinct in all the present specimens. Often its sides are raised into distinct lips, which form the white streak described above in the case of the Prison Island specimen (see Pl. XX. fig. 5). The more ventral position of the first few feet has already been remarked upon. The gills in large specimens with their twenty filaments are much more complex than any hitherto met with in East Africa or the Maldives. The differences between the descriptions and figures (*l. c.* p. 234) of setæ given for *E. collaris* and *E. perrieri* are very trifling, even more so than in the case of *E. mutabilis*.

EUNICE COCCINEA Grube. (Plate XX. figs. 6, 7.)

Eunice coccinea, Grube, Annulata Semperiana, p. 153, Taf. ix. fig. 1.

The facts that this species is one of those with few salient characteristics and is already recorded from the Philippines, Singapore, and East Africa, make it probable that a still wider distribution could be given were its synonymy fully worked out. Grube hints at this in comparing his species with *E. guildingi* Baird and *E. punctulata* Gr. Örsd., both West Indian forms, the descriptions of which, however, are too hasty to be of use. Much weight is laid on the size of the gills, which is here, as in all other species, found to be very variable. The proportions of the body and distribution of the gills offer the most marked distinctions between this species and *E. afra*, the pigmentation (as seen in spirit-specimens), prostomium and tentacles, structure of gills and setæ being almost identical in both. The parapodia differ in being smaller, especially posteriorly, and the dorsal cirri are better developed in the anterior part of the body.

Full-grown specimens are of nearly the same size as those of *E. afra*, but with a much greater bulk anteriorly though having less behind. The following list * gives the sizes of the specimens from the several localities in the Maldives:—

(1) Nairfaru, Fadiffolu Atoll, reef: one specimen incomplete, 11 mm. broad, and a fragment.
(2) Hulule, Male Atoll, reef: one specimen, 210 × 7 mm.; also a fragment.
(3) Off South Nilandu, from 24 fathoms: one, incomplete, 7 mm. broad.
(4) Off Hulule, Male Atoll, from reef and sand-flats: one small incomplete specimen, 3·5 mm. broad.

Fragments were also found in sand under boulders on Minikoi reef.

The East African specimens, none of which attain to the size reached by those from the Maldives and Seychelles, were collected as follows:—

(1) Prison Island, Zanzibar Harbour, at low tide; two fair-sized specimens, 7 mm. broad (at maximum).
(2) Ditto, in 3 fathoms off the north end of the island; one specimen, 4 mm. broad.
(3) Kokotoni Harbour, Zanzibar, 5 fathoms; a very small specimen, 2·3 mm. broad.
(4) Zanzibar Channel near its northern end, 10–15 fathoms; one specimen, 6 mm. broad.
(5) Mombasa Harbour, at low tide; two specimens, 4 mm.
(6) Wasin Harbour, 10 fathoms; one specimen, 4·5 mm.
(7) Seven large specimens collected by Dr. E. P. Wright in the Seychelles in 1868.

* See also the table on p. 294.

The species is thus seen to be widely distributed, but usually few in numbers.

The largest specimen shows an interesting abnormality of the right nuchal cirrus, by which the structure of the first foot is almost reproduced. If the supposition that nuchal or tentacular cirri are the remnants of reduced parapodia be correct, it is not surprising that variations should occur in which the ventral as well as the dorsal cirrus is retained. Text-figure 46 gives a comparison between this abnormality (*a*) and the structure of the first foot (*b*), which is here, as in most species, somewhat reduced.

Text-fig. 46.

Abnormal nuchal cirrus (*a*) and first foot (*b*) of a specimen of *E. coccinea*.

The very characteristic colour of the animal during life is subject to a small amount of variation. It approaches that described as typical by Grube most closely in the specimens from Mombasa. In one of these, which is in process of regenerating the head and anterior segments, only traces of the colour remain, while in the other it is but a little lighter now than in life. The head and anterior part of the body, a little beyond the last rudimentary gill, are of a brilliant red, of a tint between that of blood and polished copper, the ventral surface being similar but lighter. This colour spreads over tentacles, nuchal cirri, and feet, but the gills and dorsal cirri, with the exception of the first few, are now white, and nearly all colour dies out posteriorly. The sixth setigerous segment is white, and a few similar transverse marks occur behind this. In the posterior two-thirds of the gill-region every segment has a white spot in the middle line and one on each side just above the foot.

This corresponds with Grube's account, and, curiously enough, especially exactly with that of his East African specimen. The appearance in life * may, however, be altered by the presence of a brilliant iridescent green colour covering the head, tentacles, and nuchal cirri. The bases and tips of the latter are, however, white, as are the dorsal cirri, though the longer anterior ones are banded with green. The gills, though as usual red, have a greenish tinge over this. The ground-colour of this specimen, now a dull

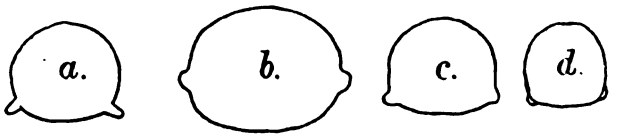
* This coloration was noted from the living specimen dredged off Prison Island. The green pigment remains visible in two other African specimens and the brown pigment and white dots in the remainder.

brown, was a dark coppery red plentifully besprinkled with lighter dots.

Grube lays some stress upon the permanence of the colour of his *E. coccinea* in spirit, but this depends upon so many factors, such as exposure to light, condition of the spirit and even the presence of other specimens in it, that great variation in this respect is inevitable.

In only one of the Maldivan examples is seen the white collar on setigerous segment number 3 which is usual in those from East Africa. The pigmentation, which has now become brown as in the above, is interrupted by more or less distinct white spots, and the skin is covered by a close network of wrinkles giving the mosaic appearance found in several species.

Text-fig. 47.



A series of sections of the body of *E. coccinea*, to show proportions in different parts. From the largest Maldivan specimen. × 2.

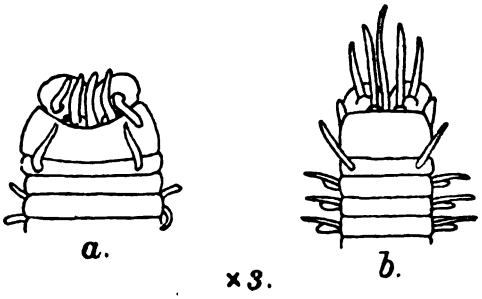
a. Through second setigerous segment.
b. „ middle of gill-region.
c. „ the point where gills decrease in size.
d. „ any part of the posterior two-thirds.

The form of the body is a characteristic contrast to *E. afra*, e. g. the body rapidly enlarges behind the head, becoming very bulky in the branchiferous region and then slender again behind this. The ventral surface is flattened, and may become concave in the middle line, but the body is highly arched dorsally throughout its length, the nearly cylindrical posterior portion having very small parapodia. The sections figured (text-fig. 47) show the usual proportions of the body in different parts, which are also illustrated by fig. 6, Pl. XX. In some cases the body is flatter anteriorly, but never so posteriorly.

The pro- and peristomia and their appendages vary widely in appearance and proportions, not only on account of accidental contractions but also varying with the size of the specimen, being better developed in the smaller specimens from East Africa than in the large ones collected from the Maldives and Seychelles. The outlines given (text-fig. 48, *a* & *b*, p. 300) are from specimens which illustrate the extremes found in this respect. That the proportions seen in fig. *a* are not quite exceptional is shown by the seven large Seychelles specimens, among which they are frequently found together with conditions intermediate between this and fig. *b*.

Compare also the shaded and outline figures of heads of *E. afra* in Pl. XX. figs. 1 & 3.

Text-fig. 48.



Outlines of the heads of two specimens of *E. coccinea*.

a. Of the largest specimen, from Fadiffolu, Maldives.
b. A large, but not extreme specimen from Hulule, Male Atoll.

The tentacles are always ringed more or less distinctly distally and sometimes for their whole length.

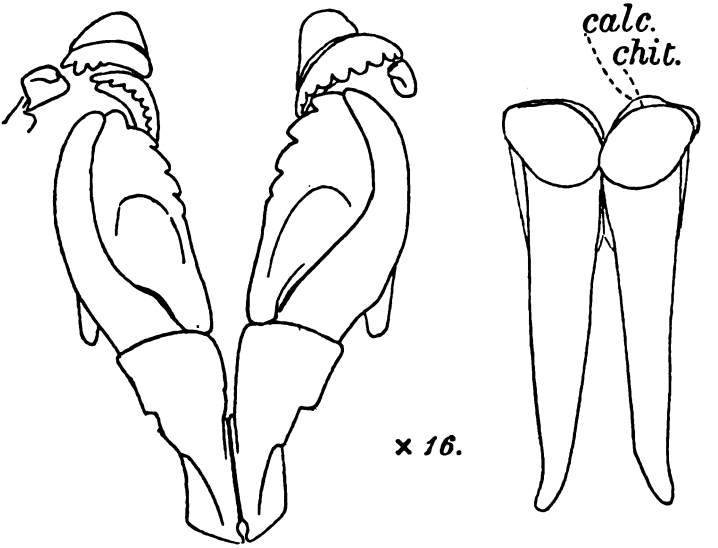
The upper jaw-plates exactly resemble those of *E. afra* both in their shape and in the numbers of the teeth they bear, as shown *e. g.* by the formula $5-4 : 6+4-9$. The end-plates of the lower jaws are, however, characteristically different, even on a first inspection, being black and nearly round. When magnified they show the peculiar markings given by Pl. XX. fig. 7. In some cases a certain amount of white calcareous matter is developed here, in others none at all, but in no case is a large calcareous end-plate formed as in *E. afra* (text-fig. 49, p. 301). The double line at the anterior border of the end-plates (marked *calc.* and *chit.*) give the maximum development of calcareous matter. See also Pl. XX. fig. 7, which represents the ends of the lower jaws of a younger specimen and shows the characteristic concentric brown bands.

As mentioned above, the parapodia are proportionately small even anteriorly, while shortly after the end of the gill-region (which extends over the anterior fifth of the body, or thereabouts) they are so reduced as to project scarcely at all (see Pl. XX. fig. 6 and text-fig. 50 (p. 301)).

At the same time the dorsal cirri, which are long and thick anteriorly, become mere slender little points. The ventral cirrus, which though short and thick is finger-shaped in the first three or four feet, becomes the usual secretory pad through the branchiferous region, at the end of which it becomes cirriform again, though only about half the size of the small dorsal cirrus. Compare the 33rd and 50th feet in text-fig. 50 (p. 301).

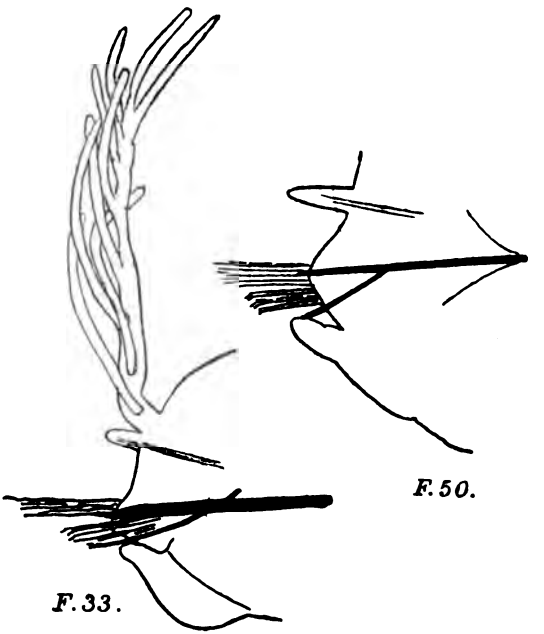
In the smaller African specimens the gills begin at the 6th foot in all but one specimen, where the first is on the 5th. In the large examples from the Maldives and Seychelles the 9th foot is more usually the first branchiferous. The number of full-sized

Text-fig. 49.



Upper and lower jaw-apparatus of *E. coccinea*.

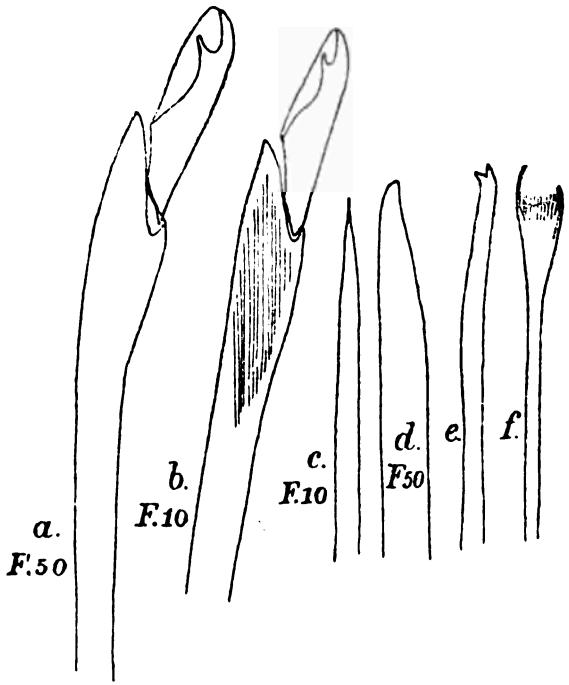
Text-fig. 50.



The 33rd and 50th feet of *E. coccinea*.

gills varies between 24 in small examples and 110 in larger. Though large, these gills do not normally cover the back, a considerable bare space remaining in the middle except in two cases, one from the Maldives and one from East Africa, where those of either side mingle in the mid-dorsal line. The maximum number of filaments varies between 6 in small to 17 in the larger, though the single, very small specimen from Kokotoni has but three. Posteriorly we find a very variable number of small and even quite rudimentary gills composed of from three to one filament, there being 12 or 15 in small specimens and about 50 in others, their number again varying roughly with the size of the specimen. See the figure of the whole worm (Pl. XX. fig. 6).

Text-fig. 51.



Setæ of *E. coccinea*.

a, *b*, *f*, × 350; *c*, *d*, *e*, × 70.

a & *b*. Compound setæ from 10th and 50th feet respectively.
c. Aciculum (one of three) from 10th foot.
d. The single aciculum from the 50th foot.
e. Acicular hooked seta from the same foot.
f. A comb seta (the teeth are less distinct in nature than in this figure).

The setæ are of the same type as those of *E. afra* described above, viz. bent capillaries, triangular ending combs with very fine teeth, and hooked compound setæ. Of these latter, specimens

taken from anterior feet differ somewhat from those from posterior. Compare *a* and *b* in text-fig. 51, p. 302, which are from the 50th and the 10th foot respectively of the same specimen. The anterior feet may contain three acicula, some of which end in peculiarly elongated points (text-fig. 51, *c*). Posteriorly a single thicker aciculum (*d*) accompanies a slender but black acicular seta which ends distally in two small hooks. These latter project markedly from posterior feet.

The subjoined table gives the principal variations observed in the specimens from the Maldives and Seychelles.

Specimen from	Size of body.	Large gills on feet nos.	Followed by rudimentary gills.	Maximum no. of filaments.	Length of prostomium.	Length of tentacles.	How far these jointed.
Hulule Male (dredged)	mm. −×3·5	5—47	15	9*	mm. 2	mm. 3	Over whole length.
S. Nilandu ...	−×7	5—50	15	13	3	10†	ditto.
Hulule Male (reef) ...	210×7	6—60	18	17	3	5	Only distally.
Fadiffolu	−×11	9—120	about 50	13	3	3	Wrinkled only.
Seychelles	×9·5 up to 11.	Always begin at 9 and extend to 80 100.	about 50	10—17 according to size of specimen.	2	3 or 4	Distally jointed.

EUNICE TUBIFEX, sp. n. (Plate XXI. figs. 1–8.)

One of the five‡ species which make stiff leathery tubes with lateral openings. This is distinguished from all other species of the genus except *E. depressa* Schm.§ by the possession of both the kinds of compound setæ found in the family, viz. those with knife-shaped and those with hooked sickle-shaped end-pieces. The former occur in the anterior feet, then for a short distance both together, and finally for the greater part of the body's length the ordinary "Sichelborsten" occur alone.

The worms were first collected through the kindness of Capt. Agnew, R.N.R., who allowed me to accompany the Zanzibar Government Steamer when engaged in putting fresh chains to the buoys which mark the southern approaches to Zanzibar. The tubes, which are a foot or more long by about three-eighths of an inch in diameter, were found attached singly to the chains, from which they projected horizontally. All were overgrown with hydroids, polyzoa, and alcyonarians, which, with the organisms collected from the under surface of the buoys themselves, formed

* This is one of the specimens in which the gills overlap across the back. The gills are not abnormally complex.
† The tentacles are abnormally slender distally and may have been injured.
‡ See second note on page 308.
§ See first note on page 308.

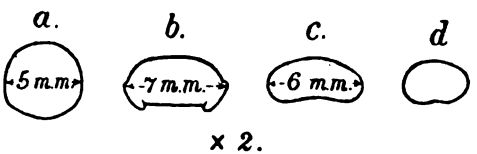
a most important addition to my collection, since several species of all these groups were here met with for the first time. Some time later I came across specimens of this species at low spring-tide on the west shore of Puopo Islet, Kokotoni Harbour, Zanzibar. Here the tubes were attached at their bases to the flat rock, and were stiff enough to stand vertically upright even when the water had left them. Tubes were also dredged in Wasin Harbour, whence also come three much younger specimens, which show important differences from the full-grown ones previously collected.

The openings of the tubes are arranged more or less alternately on either side as in *E. tibiana* Ehl., but are less numerous and the tubes are straighter. The basal part of the tube is very like the fragment figured by Ehlers (*l. c.* Taf. 22. fig. 1), which shows well their characteristic texture and surface. Although the tube-wall is not thicker than ordinary brown paper and is free from foreign material, it is perfectly opaque and so tough and elastic that the tubes are cut or torn open with some difficulty.

The colour of the animal in life is uniformly blood-red, except towards the hind end, where the body becomes blackish.

The head is broad and the peristomial segment, as usual, cylindrical (Pl. XXI. fig. 1), but immediately behind this the body flattens ventrally, and a little later dorsally also, becoming in section a narrow rectangle. A slight increase in breadth takes place for a centimetre or two behind the head, after which the body is parallel-sided for the greater part of its length, becoming narrower and more cylindrical towards the tail. The diagrammatic sections explain these changes (text-fig. 52). The segments are very short throughout, though the six following the head are longer than the rest (see fig. 1, Pl. XXI.).

Text-fig. 52.



Diagrammatic sections of body of *E. tubifex*, sp. n.

a. Just behind buccal segment.
b. In region of glandular feet, *i. e.* about 24th segment.
c. In the branchial region.
d. Near hind end of body.

The prostomium (Pl. XXI. fig. 1) is short and broad, deeply notched in front and covered by the anterior edge of the buccal segment behind. The short and thick tentacles are indistinctly ringed and have each a small thickened basal portion. The middle one is about twice as long as the prostomium, the next

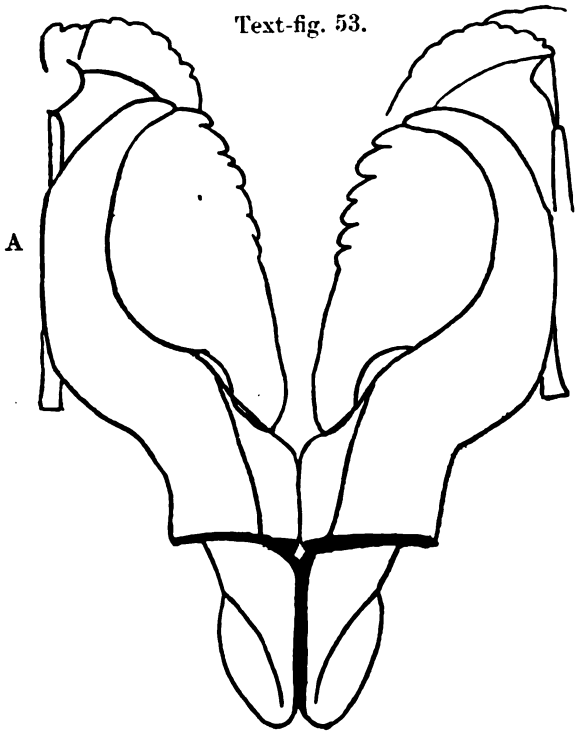
pair but very little shorter, while the outer are but half this length. The median pair is inserted at the same level as the middle tentacle, but at some distance laterally from it and close to the outer pair, the insertion of which is more anterior. Immediately beneath these last are the small but distinct eyes. The first ring of the peristomium is of moderate length, the second very short, and the nuchal cirri are small and smooth.

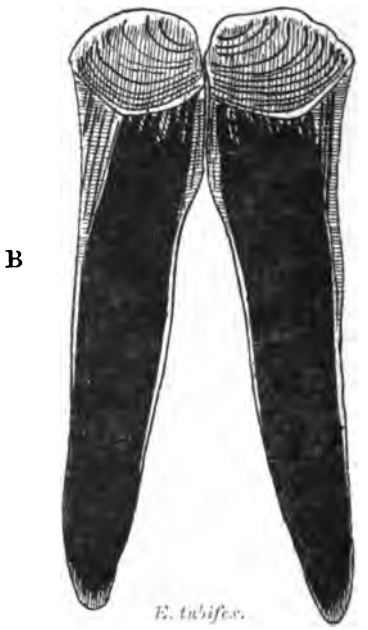
The jaw-apparatus is very powerful (text-fig. 53, p. 306), consisting of thick black plates sparingly bordered with white matter. The end-plates of the lower jaws are small and but partially calcareous, being marked by dark chitinous rings, as shown in the figure (text-fig. 53, B, p. 306). The upper plates are of the usual form, the great dentals being broad and bearing sharp closely-set teeth. The formula is 6—7 : 7 + 2—9; the small number of teeth on the second left crescentic plate is due to its being toothless over the greater part of its cutting-edge, a condition found less prominently in many species, e. g. *E. afra*. Outside all are two paragnaths on either side, the anterior and inner pair bearing one triangular tooth each, the posterior being mere elongated chitinous bands.

The feet project but little, though the setæ stand out prominently. The dorsal cirri are fairly long, projecting well beyond the setæ, except in the first three feet and those near the hind end of the body. The ventral cirri are highly modified, forming secretory pads, in somewhat the same way as in *Diopatra*. The first is thick and finger-shaped, but they rapidly become still thicker until the twelfth is a conical knob as large as the setigerous portion of the foot. The breadth continuing to increase dorso-ventrally, at the 24th foot it is nearly three times as wide as this. Since these pads are broader than the feet, they are pressed together fairly closely, forming an almost continuous band down the sides of this region of the body, as shown in Pl. XXI. fig. 4. Ventrally they end in a free flap, dorsally in a little point, the remnant of the true cirrus. The figures of the feet (text-fig. 54, p. 307) explain the changes of form and arrangement of these organs. The lower border and inner angle of the pads are extremely vascular, and, at about the 120th foot, these surfaces contain a close network of blood-vessels. Posteriorly, at the point where the gills become conspicuous, the pads gradually decrease in length, and when the former attain their full size about segment 120, the latter become rapidly smaller, and for the rest of the body beyond segment 130 are merely little conical points. One lip of the seta-sac is pointed and projects a little beyond the other, which is rounded.

The gills begin at foot 35 as a small papilla and do not become at all conspicuous until about the 70th foot, where they consist of two filaments somewhat larger than the dorsal cirrus. From this point they increase uniformly, until, at the 120th foot, five long filaments are found arising from a short rachis, a condition which seems to last to near the anus (Pl. XXI. figs. 1, 2, & 3).

Text-fig. 53.

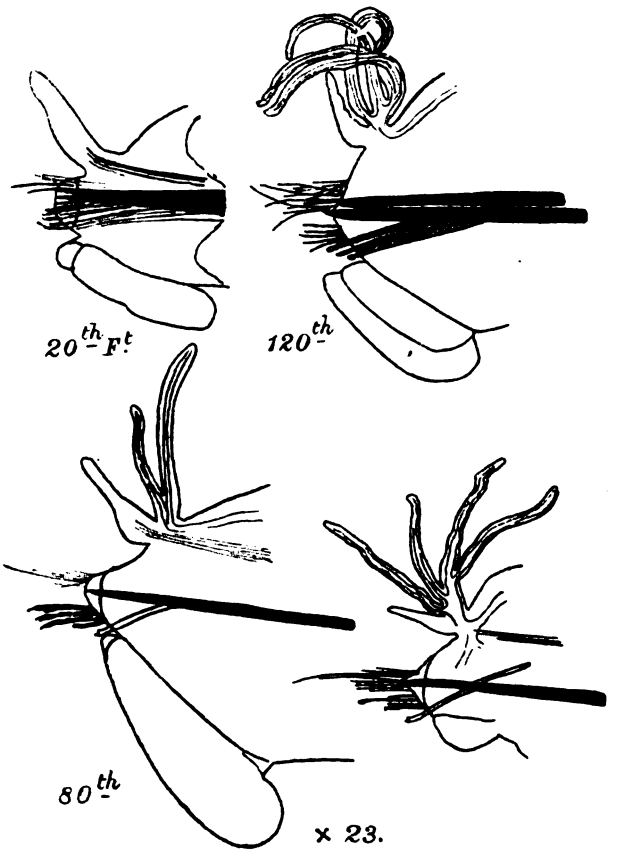




A.—Upper jaw-plates of an adult specimen.
B.—Lower jaw-plates of the same.
Both × 18.

The setæ are, anteriorly at least, in dense well projecting bundles (Pl. XXI. fig. 5), and of characteristic strength, form, and colour. The majority of each kind are of a yellow colour, and have a more markedly granular surface than even those of *E. aphroditois*, and all except the combs are strongly striated. These last are about as numerous as the capillaries posteriorly, and thus, as in form, recall those of *E. aphroditois*.

Text-fig. 54.



Feet of an adult specimen of *E. tubifex*.

The lower right-hand figure represents one from near the hind end of the body.

Both capillary and compound setæ are thick and strong, and the former are shorter than usual, recalling those of *Diopatra*. The acicula are two or three in number anteriorly, but further back only one, accompanied by one or two, more rarely three, acicular setæ. The former are densely black except at their points, which are bevelled and slightly bent (Pl. XXI. figs. 5 and

8, *e*); the latter are yellow, more or less sharply bent towards their end, which is two-hooked and normally covered by a guard (Pl. XXI. fig. 6, *a*). The compound setæ are of two kinds. In the anterior feet are found setæ whose end-pieces are knife-shaped (Pl. XXI. fig. 6, *b*). At about the 130th segment (at which point the ventral cirrus has changed from a broad secretory pad to a conical form) those with two-hooked ends appear and shortly thereafter are the only kind occurring. Groups of setæ in which all these forms occur are shown in Pl. XXI. figs. 5 & 6, *a*–*e*.

Plate XXI. fig. 5 shows the setæ of the 100th foot of an adult specimen, in which numerous combs, dark-coloured bordered and striated capillary, and both kinds of compound setæ are present. Posteriorly the combs remain equally numerous while the number of the other kinds decreases, and the knife-shaped compound setæ disappear and are replaced by the hooked form. One of these is shown enlarged in Pl. XXI. fig. 6 (*c*), while *b* and *d* show the knife-ended form and combs. *a* is one of the two-hooked acicular setæ from the tail-region of an adult, showing merely the remnant of the broken guard. In all these setæ the granulation of the surface is well shown. As, however, this and the deep yellow colour are not present in freshly formed setæ, but only in those which have been in use some time, I am inclined to believe the appearance due to an accidental coating of a rust-coloured deposit which is found inside the tubes, especially posteriorly, and on the bodies of the worms.

This difference in the setæ of anterior and posterior feet is quite distinctive of this among all the species of the genus *. Another member of the same group, *E. conglomerans* Ehl. (*loc. cit.* p. 93). also shows a difference in the compound setæ of anterior and posterior feet; but those of the former, instead of being "Säbelborsten," show an interesting intermediate stage between the two forms (*loc. cit.* pl. 24. fig. 4). In examining the end-pieces of the compound setæ of *Eunice indica*, which are characterised by the prolongation of the guard to a point beyond the hooks (see fig. 12, *c*, Pl. XXI.), one is struck by the resemblance of the outline of the whole to that of one of the "Säbelborsten" so commonly found in the species of *Marphysa*. The fusion of the hooks with the guard and the strengthening of the latter in *E. indica* would form a typical knife-like end-piece. In *E. conglomerans* this fusion and strengthening have partially taken place, but the lack of a point to the guard obscures the likeness in outline.

Of the four † other members of this group, *Eunice conglomerans*

* Except *E. depressa* (Schmarda, Neue wirbellose Thiere, p. 127), the description of which is so slight as to be practically useless. Grube (Mitth. über die Fam. der Eunicean) gives the species as a *Marphysa*, upon what evidence except its possession of these "Säbelborsten" is not known. *Marphysa fallax* is the only other Eunicid in which these two kinds of setæ occur in one worm, and *Eunice impera* Grube (Annulata Semperiana) and *E. jeffreysii* McIntosh (Annals & Mag. Nat. Hist. ser. 7, vol. xii. 1903) are the only other species of *Eunice* in which "Säbelborsten" occur.

† Roule (Comptes Rendus, tom. cxxvi. p. 1167) includes *Eunice amphiheliæ*, *E. floridana*, and *E. philocorallia* all under *E. gunneri* Storm, thus reducing the group to four members in all.

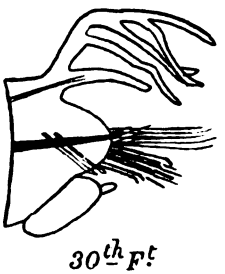
shows a close relationship in other respects besides the compound setæ considered above. The general form of the body, insertion and length of the tentacles, late commencement of the gills, form of the ventral cirri, and details of the setæ other than those mentioned above, are all points in which this species differs from both *E. tibiana* and *E. floridana* and approaches *E. tubifex*. At the same time the difference between the two species in all these characters is perfectly distinct.

The smaller specimens are not at once recognisable as belonging to the same species, striking and interesting differences occurring between them and the full-grown examples.

Two of the fragments consist of a head and fifty segments each, measuring 35 mm. in length by 4 mm. in breadth, the third of a head and 35 segments measuring 13 mm. in length and 2·5 mm. in breadth.

Fragments of two tubes were dredged with the above-named specimens, and these differ from those of adults in being soft and translucent. The proportions of the body, head and its appendages are as above, though the sides of the body are not so vertical because the secretory pads are much less developed. These are in proportion about one-third the size to which they attain in the full-grown specimen, remaining conical in shape and being without the free lappet ventrally. Their maximum development is shown in the figure of the 30th foot (text-fig. 55).

Text-fig. 55.



Thirtieth foot of a young specimen of *E. tubifex*, to show maximum development of the secretory pad. × 18.

The jaws of the larger of these fragments are in shape and proportion like those described above, but the numbers of the teeth are somewhat smaller, as shown by their formula 4 − 4 : 8 + 2 − 8. In the smallest of all a great difference in the appearance of the whole is brought about by a further lessening of the number of teeth and by the delicate translucent brown material of the plates. Fig. 7, Pl. XXI., represents this apparatus, and a comparison of this with text-fig. 53, A (page 306), shows that in other respects the jaws of young and full-grown examples are alike.

In this smallest specimen the gills begin at foot 21, and the thirteen pairs present consist of one or two filaments, which are only as long as the dorsal cirrus; in the two larger specimens they begin at feet 15 and 17 and consist of three or four longer filaments attached to a short rachis as in the adult. Apparently in correlation with the early appearance of the gills, the knife-ended compound setæ are confined to a few of the anterior segments. In the smallest example a single hooked seta is present in the eighth foot and by the twelfth has replaced all but two of the former kind, though one knife-ended seta still exists in the twentieth foot. In the larger fragments hooked setæ appear at about the eighteenth segment, and a few knife setæ continue in decreasing numbers for about twelve segments more, after which only the former are present. The ordinary setæ are all nearly colourless, and in the smallest specimen the acicula and acicular setæ are of a light brown tint. In the smallest the acicular setæ begin at the sixteenth foot, in the larger at the thirtieth as against the eightieth in those full-grown. Fig. 8, Pl. XXI., shows these setæ, *b* and *c* the two kinds of compound, *a* and *d* two shapes of the acicular setæ, and *e* the aciculum. Contrast Pl. XXI. fig. 6.

The character of the tube-fragments found and the state of the ventral cirri show that the modifications for the tubicolous mode of life are not yet completed, and among these are to be reckoned the later appearance of the gills and of the change in the setæ. The long row of rudiments of gills in front of those which are of a functionally useful size in the adult are doubtless vestiges of the anterior gills of the young which atrophy when the worm attains its full size and enters upon its peculiar tubicolous mode of life. It is interesting to note that here, as in the case of *Eunice indica*, structural immaturity is no bar to sexual ripeness, since one of these fragments is loaded with large eggs.

The empty tubes, described by Whitelegge as resembling those of *E. tibiana*, brought from Funafuti, most probably belonged to this species, and are evidence of its wide distribution through the Indo-Pacific area.

EUNICE MURRAYI McI.

E. murrayi McIntosh, 'Challenger' Reports, vol. xii. p. 288, pl. xxxix. figs. 7 & 8, pl. xx. figs. 19 & 20.

Two large specimens, 6 mm. broad over all, from among coral at lowest tide-level, Pungutiayu Islet, East Africa; two others, very little smaller, from 10 fathoms in Wasin Harbour; one minute specimen, incomplete, dredged from 2 or 3 fathoms in Chuaka Bay, Island of Zanzibar.

From the Maldives are two large specimens from the reefs at Hulule, Male Atoll, and Goidu Atoll.

Speaking roughly, the species is like *Eunice antennata*, but with the gills confined to the anterior segments, the other differences between the two species, though occurring in every part, being inconspicuous. But in mode of life and appearance when alive, the species is distinct from all others. The two specimens from

Pungutiayu were found inhabiting tubes made of comparatively large fragments of shell and pebbles attached lengthwise to the underside of a stone. This mode of tube-building is common among *e. g.* the Terebellidæ *, but forms a contrast to the more or less free tubes of most tubicolous Eunicidæ. The apparent absence of tubes in the case of dredged specimens is not surprising in view of its lack in such a worm as *Onuphis holobranchiata*.

The ground-colour of the body is greenish, like that of verdigris, in tint, mottled with light brown. The tentacles, nuchal and dorsal cirri are annulated, the former being quite moniliform and the constrictions are emphasised by lines of chocolate-red. The large gills are blood-red.

These specimens correspond in all details with the single example dredged by the 'Challenger' in 18 fathoms off the Cape of Good Hope, except that at first it seemed that the latter had fewer teeth on its jaw-plates and differed in the distribution of its gills. These differences are, however, accounted for by an examination of the variation of the specimens before us.

The formula for the teeth given by the 'Challenger' Report, viz. $5-6:5+6-9$, is different to that of the majority of these specimens, which vary about $6-7:6+8-12$, but is very near that of one specimen, $5-6:5+8-10$. The largest number of teeth found on the great dental plates is seven on each.

In these specimens the gills begin on the third foot, with one exception, where the first branchiferous is the fourth foot. In that of the 'Challenger' they begin on the fifth or sixth. However, a state approximate to this latter is found in three of the six specimens, whose first two, three, or four gills are very short simple filaments, mere vestiges of those found on the corresponding feet in the remaining three specimens. The last gill-bearing foot is usually about the forty-fifth, but may be between the twenty-ninth and fifty-fifth in specimens of approximately the same size. The maximum number of filaments found is twelve, and the gills may or may not meet over the back.

Prof. McIntosh's figures of the Cape specimen correspond exactly with the parts they represent in these specimens also. As he notes, the tentacles should be longer, as in *E. antennata*. Also the trifid ends of the acicular setæ are normally covered by a guard in the usual way.

A *résumé* of the remaining differences between this species and the two succeeding may be useful to future workers.

The form of the body is as in *E. antennata*, and though somewhat flatter anteriorly, is equally highly arched dorsally behind. The prostomium and its appendages form another likeness, but the tentacles are more distinctly moniliform than in the majority of specimens of *E. antennata*. The strength and size of the dental apparatus, the shape of its plates (especially the lower or mandibular) and the numbers of the teeth they bear, are so closely alike in this

* It is possible of course that the worms were inhabiting the tube of a Terebellid temporarily, but not likely that two such tubes should have been left vacant and occupied by the same species of Eunicid at the same time and place.

species and *E. antennata* that these structures afford no certain means for their separation.

The size and distribution of the gills form a striking likeness to *E. indica*.

The setæ are like those of *E. indica* in the bent, bluntly pointed termination of the acicula, absence of a third hook to the compound setæ of posterior feet, and the presence of three or even five of the trifid acicular setæ in each foot. But the guard of the compound setæ is not produced to a point beyond the hooks in the way which is so characteristic of *E. indica*.

The young specimen, less than 1 mm. broad, referred to above is but doubtfully identified as of this species. The prostomium is quite undivided in front, but the tentacles are very deeply annulated. Simple gills, as long as the dorsal cirri, occur on feet 6 to 10 only. The setæ are of the *antennata* type.

A very nearly allied species is described by Ehlers (Florida Anneliden), named *E. rubra* by Grube (Annulata Oerstediana). The jaws, however, are delicate plates and the acicular seta is sometimes bidentate.

EUNICE ANTENNATA Sav. (Plate XXII. figs. 1–7.)

Eunice antennata Ehlers, Ostafricanische Borstenwürmer, Nachr. Ges. Gött. 1897.

E. flaccida Grube, Anneliden des Rothen Meeres, Monatsb. d. k. Akad. Wiss. Berlin, 1869; Gravier, Nouv. Arch. du Muséum de Paris, 1900.

E. torresiensis McI., 'Challenger' Reports, xii. p. 270.

E. elseyi Baird, McI. tom. cit. p. 286.

**E. paucibranchiata* Grube.

The identity of this common species with Grube's *E. flaccida* is rendered certain by the full description of specimens from the same locality by Gravier. Although Ehlers does not give reasons for his identification of the specimens from Zanzibar which he examined with Savigny's *E. antennata* from the Gulf of Suez, it is evident that he is dealing with the same species again, so that the circumstantial evidence for the identity of the two amounts to a practical certainty. Savigny's description taken by itself is hardly sufficient, as he does not describe the setæ nor the jaw-plates with enough care. The figures of the head, feet and gills, and general body-form can, however, hardly be surpassed.

The abundance of large specimens of this species in East Africa forms a contrast with its comparative rarity in the Maldives, whence only two full-grown specimens were obtained. This difference is probably connected with the habitat (which, for the African specimens, is given below), and it is conceivable that a dwarf variety has been evolved in the latter locality. In Ehren-

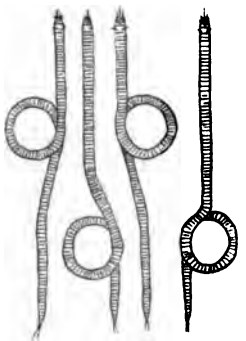
* I owe the discovery of this synonym to the examination of a specimen lately lent to me by Prof. McIntosh, which was labelled by Prof. Grube himself and recorded from the Bass Straits. See note on *E. bassensis*, page 318.

berg's collection from the Red Sea but one fragment occurred, in Gravier's three specimens, all small, while only one specimen is contained in the collections made by Semper in the Philippines.

The worm presents distinct variations in correspondence with its habitat. The five largest specimens, measuring 100 mm. by 5 or 6 inclusive of the feet, were obtained by digging in the beach of clean and rather coarse sand, just below the British Agency at Zanzibar, which appeared to be habitable to them and to *Diopatra neapolitana* alone. These were of a pink or flesh-colour with sparsely scattered specks of brown pigment. Many specimens of all sizes up to that given above were found on the shore, and dredged from among sponge and Alcyonaria &c., at a depth of 10 fathoms in Wasin Harbour. Of these some were similarly coloured, but in many others the brown pigment was more or less uniformly developed, so that the body was of a metallic brown with white spots, of which one in the middle of each segment dorsally was especially prominent. The gills were white even in life, but this loss of colour may have been accidental owing to the deoxidation of the water in which they were kept before examination.

At low spring-tide level in Chuaka Bay the worm is very common, living in the dense tufts of *Halimeda* which are so abundant there, and in the cavities of sponges. All have

Text-fig. 56.



E. antennata, in the act of swimming.

developed more or less green tint, in some only about the head, but in the majority the whole body is of a fine dark green colour harmonising well with that of the *Halimeda*. None of the specimens found here attain to the size of those from the sand at Zanzibar, the largest of these measuring 80 mm. × 4. When disturbed the worms swim by coiling the body in the way shown in text-fig. 56, the coil passing down to the tail and being then formed afresh at the head, a peculiar mode of motion also

observed in the Wasin specimens. On taking hold of the worm it wriggles violently, and if not promptly liberated into the collecting-jar the free end breaks away and is lost among the seaweed. Though it is necessary thus to use care and deftness in handling the living specimens, the worm does not undergo autotomy when dropped into spirit or corrosive sublimate solution, as would be the case with *e.g.* some Nemertines. It seems very probable that both colour and the possession of this faculty are protective, though opportunity was lacking of testing this experimentally.

This variety appears to be sufficiently distinct to merit a name. *E. antennata* var. *viridis*.

A fragment of a large specimen was collected on the shore near Mombasa, concerning which, however, I have no notes.

The Maldivan specimens were collected as follows:—

One complete specimen, 65 mm. × 3 mm., from 5–7 fathoms in the lagoon of Minikoi Atoll, a fragment of a rather smaller specimen from 7–9 fathoms at the northern side of the same lagoon, and a third from breaking up stones on the reef.

The remaining numerous specimens are very small, but one or two millimetres in breadth.

Off Mahlos Atoll, from 23 fathoms, bottom of sand, stone, and weed, one small specimen 2·5 mm. broad.

Off Fadiffolu, from 12 fathoms, bottom hard sand and sponge, two small fragments.

Off North Male, two small fragments from 27 fathoms and one from 20 fathoms, bottom broken shells and rubble.

From the reef at Hulule, Male Atoll, eight complete specimens about 2 mm. wide.

Small specimens seem to be widely distributed in the Archipelago and to be of varied habitat.

It would hardly be possible to re-identify this species as that collected by Ehrenberg in the Red Sea, were it not that Gravier (*l. c.* p. 255) in his examination of Polychæta from the same locality redescribes it in a thorough manner, mentioning some of its important variations. As in both cases the specimens examined were very small, in spite of their sexual maturity, the presence in these collections of numerous large examples enables me to supplement Gravier's account in some particulars.

In the first place, the form described by him as typical in having, like Grube's, smooth tentacular and dorsal cirri is exceptional, these appendages being generally distinctly annulated and occasionally quite moniliform. Of fifty African specimens of all sizes examined with special detail, 36 per cent. had these appendages very distinctly ringed, as in both those from the Maldives and in Savigny's species. In none of these specimens have I seen the peculiar prolongations of the eyes embracing the base of the middle paired tentacles as figured by Gravier. The eye-spots are of a characteristic form, like that of the half-moon.

The form of the body is characteristic, being almost cylindrical anteriorly, and though flattened posteriorly remains more or less

highly arched on its dorsal surface throughout (see text-fig. 57): the long segments bear well projecting feet distinctly separated from one another, though many of the small Maldivan specimens form an exception in this respect.

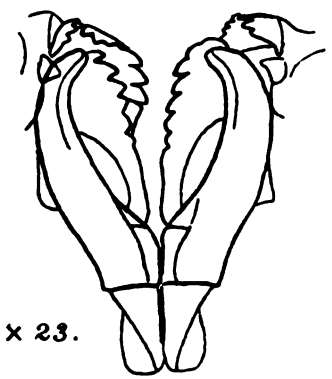
The prostomium, at least in adult specimens, is broad and usually deeply notched in front in 72 per cent. of the specimens (compare the figures 1 & 2, Pl. XXII.), in contradistinction to the allied species, *E. indica* (Pl. XXI. fig. 9). The palps are, in 46 per cent. of those examined, grooved diagonally below, as shown in Pl. XXII. fig. 3, and in a few cases so deeply as to make the prostomium quadripartite when seen from above, as in Kinberg's division of the genus, *Eryphyle*, which for this reason is not recognised in the preceding table of species.

Text-fig. 57.

× 5.

Sections of body of *E. antennata*.
a. Through buccal segment. | *b*. Position of largest gills.
Hind part of body remains as *b*.
From a large specimen of var. *viridis*. × 5.

Text-fig. 58.



Upper jaw-plates of *E. antennata*, a large specimen. × 23.

The buccal and succeeding segments are nearly as thick as the broadest in the body (Pl. XXII. fig. 1), an important and constant character of the species.

The jaw-apparatus in my specimens does not agree well with

Gravier's figure, and as that of Savigny is not very intelligible, I append a representation of it in text-fig. 58, p. 315, and fig. 4, Pl. XXII. The most striking feature is the strong development of the left unpaired lateral, which lies alongside the great dental in a way which recalls the arrangement of these parts in the Onuphidinæ. This arrangement, carried still further, is found, however, in several species of the genus, e. g. *E. indica*. The following are some formulæ of the teeth, which form a contrast to the larger numbers found in *E. indica*:—

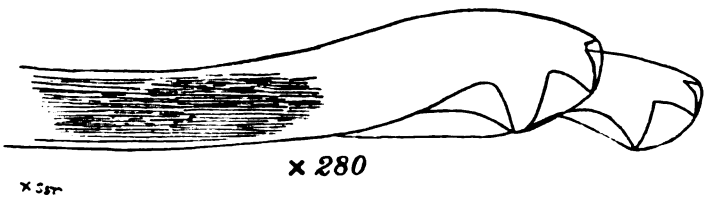
6—7 : 10+9—8;	5—7 : 7+7—12;
5—7 : 7+7—8;	5—6 : 5+8— 9.

In large specimens the plates are strongly made, dark brown throughout, and but sparingly bordered with white matter, except the end-pieces of the lower jaws, which are purely calcareous. Even in small specimens, in which the lower plates are white throughout, the chitin is well developed over the whole of the upper, so that in all cases a marked contrast exists between these and the feeble, almost completely calcareous plates of *E. indica*. There are no differences between the great dental plates of either side which could amount to the "*dissymmetrie frappante*" described by Gravier (*l. c.* p. 257), whose description and figure recall rather these parts in *E. indica* (see p. 320). As usual in most species, the left plate bears slightly fewer teeth, of which the uppermost is better developed than that on the right, but this is all. The maxillary forceps are very strong and broad, and in the older specimens bear a ridge dorsally near their points, as indicated in text-fig. 58 (p. 315).

I do not find the two projections of the dorsal cirrus in the anterior feet which Gravier describes.

The setæ agree well with Gravier's figures. All are smooth and of a light colour. The compound setæ show no, or but little,

Text-fig. 59.



Two acicular setæ of *E. antennata* in their natural relative positions. Compare the shapes of their hooks.

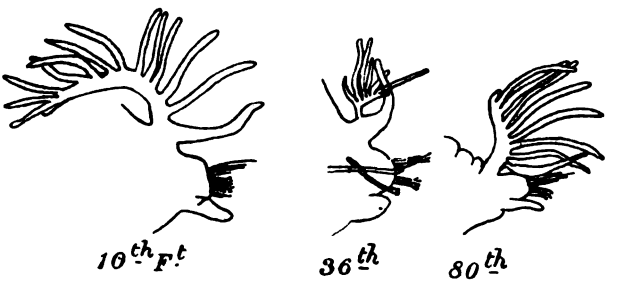
striation, and the acicula are not black, though striated longitudinally. There is, however, no joint in the acicular setæ, which are invariably three-hooked, of a bright yellow colour, and generally

considerably bent (text-fig. 59, p. 316). In the posterior feet this tendency to the addition of a third small hook often makes itself apparent in the ordinary compound setæ also, and even the acicula are sometimes bifid at their extremity, though the form of the projections they bear is not such that they could rightly be described as hooked, Pl. XXII. figs. 5 & 6. (Compare the species described below, and also *E. elseyi*, Baird, 'Challenger' Report, xii. pl. xx A. figs. 14, 15, 16.)

There are two acicula throughout, and only one or two acicular setæ posteriorly (cf. *E. indica*, where there may be as many as four).

The gills are well developed, very regular in form, and of stiff consistency, the name "*flaccida*" being equally a misnomer whether applied to them or to the body of any of these specimens, large or small. They vary in length and complication to some extent independently of the size of the worm, but never quite cover the back. The first appears with great regularity on the 6th foot, only in 16 per cent. being on the 5th, and only one case each on the 3rd, 4th, and 7th. The largest gills, which may be composed of 15 filaments, are only found anteriorly from the 7th to the 20th foot in small specimens, or as far as the 40th in large.

Text-fig. 60.



Three feet of *E. antennata* (a small specimen of var. *viridis*), showing the proportions of the gills in anterior, middle, and posterior parts of the body.

From this point to one approximately the same distance from the tail a variable amount of reduction takes place, after which, in the hinder third of the body, the gills again become large (see figure of hind end of body, Pl. XXII. fig. 7 and text-fig. 60), though never equal to those of the anterior end *. The reduction in the middle region may be sufficient to cause a striking difference in the appearance of the animal, or, in large specimens, be not apparent until a close examination is made. In a few specimens the gills are reduced to single filaments, or even disappear altogether in the

* A similar phenomenon is noted in the case of *E. torresiensis* by McIntosh 'Challenger,' xii. p. 271.

middle region, reappearing as combs of three or more filaments posteriorly. In very young specimens, 1 mm. or so wide, the gills are all small and simple and not developed at all posteriorly. It is thus sometimes difficult to determine a specimen of this species whose posterior part is missing, but generally the distinct annulations of the tentacles, and the breadth and deep notch of the prostomium, form a sufficient distinction from the allied *E. indica*.

This enlargement of the gills at the ends of the body is evidently connected with the habits of the worm, by which the head and tail, especially the former, are more frequently brought into contact with the fresher water outside the burrow.

The relationships of this species to those next following are shown in the table on p. 287. It is also nearly related to, if not synonymous with, *E. torresiensis* McI. (*loc. cit.* p. 270), with which it agrees in every particular, except that in the latter, though the jaw-apparatus is of quite similar form, the numbers of the teeth are smaller, and the gills in all his specimens begin at the fourth foot. These variations are not important, and by the inclusion of these specimens the range of the species is extended to the Torres Straits. The species which McIntosh doubtfully identifies with *E. elseyi* Baird (*loc. cit.* p. 286) from the Arafura Sea, North Australia, agrees in every detail except the shape of the mandibular or lower jaw-plates, which are here remarkably short in proportion to the length of the upper. In the head and its appendages, feet, setæ, gills, and their distribution the species are identical.

Similarly the fragment named by McIntosh *E. bassensis* (*loc. cit.* p. 298) has features peculiar to *E. flaccida* in its large posterior gills, annulated anal and dorsal cirri, and golden three-hooked acicular setæ. An extension of range to include the Bass Straits cannot, however, be held proven until better evidence than that afforded by a single fragment can be adduced (but see note at bottom of page 312, which gives the required corroboration).

EUNICE INDICA Kbg. (Plate XXI. figs. 9–12.)

Eunice congesta Marenzeller, "Südjapanische Anneliden," Denkschr. Akad. Wien, xli. 1879, p. 134.

This species, first recorded by Kinberg from Banks' Strait*, and later by Grube from the Philippines, Marenzeller from the south of Japan, and Gravier from the Red Sea, is represented in these collections by more numerous and larger specimens than in any of the above mentioned. The largest measures 75 mm. × 4 mm., and is one of the five of nearly equal size collected from among sponges &c. at low spring-tide level in Chuaka Bay. From the western side of Zanzibar come two specimens, one nearly as large as the large Chuaka Bay example and one smaller, while

* According to McIntosh, *loc. cit.* Presumably Straits of Banca to the west of Sumatra are meant, not the Banks' Strait off the Canadian north-west.

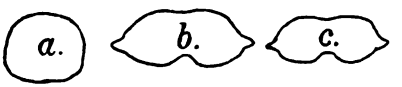
Wasin Harbour yielded seven, of which four are quite small (1 mm. or so broad) and the rest intermediate in size between these and the specimens from Zanzibar.

In the Maldives six very small incomplete specimens (measuring 1·5 mm. in breadth) were dredged from 30 fathoms off Suvadiva Atoll from a rough stony bottom. These are interesting in that they are sexually mature in spite of their size and the undeveloped state of their gills, of which the largest consist of three or four filaments and do not by any means cover the back. Three of these specimens are distended with large ova and three with sperm.

Four, 1 mm. wide, from 20 fathoms off North Mahlos Atoll, with small gills and an abundance of yellow-brown pigment. Another, still smaller and with gills of only two filaments, was dredged in the northern part of Minikoi lagoon from 7–9 fathoms of water, and two very small fragments were dredged off Mahlos from 23 fathoms, bottom sand, stone, and weeds, and off Fadiffolu, 12 fathoms, bottom hard sand and sponge.

The form of the body is, as usual, characteristic, and notably different from that of *E. antennata* and *E. murrayi* in the smallness of the prostomium and narrowness of the buccal and first two

Text-fig. 61.



× 5

Sections of body of *E. indica*.

a. Through buccal or succeeding two or three segments.
b. Middle of gill-region.
c. At ¾ length of body.

From a full-sized specimen; the smaller ones are rounder.

abranchiferous segments. The only cylindrical portion of the body being thus inconspicuous, the whole appears flattened. The broadest and flattest part of the body is not far behind the head, near the beginning of the branchiferous region. These proportions are shown in Pl. XXII. fig. 9 and text-fig. 61, which represent the condition of a preserved specimen *. It was noted at the time of killing that the slender anterior end is especially contractile in this species.

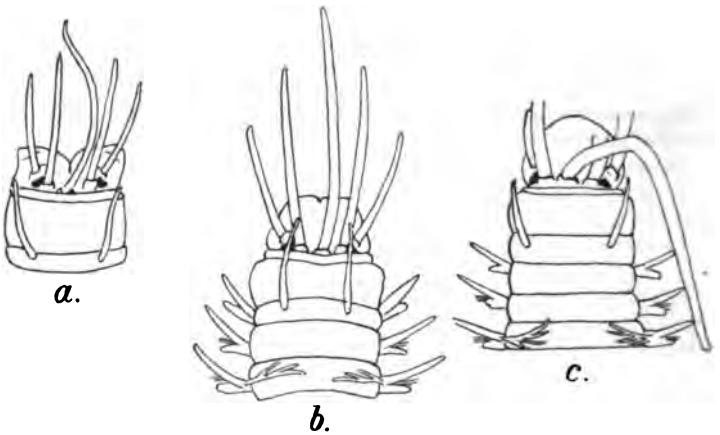
As regards colour, notes made from the living animals give the following variations:—A fair-sized specimen from Chuaka was

* In comparing these figures with that given by Gravier (*l. c.* pl. xiii. fig. 70), it must be borne in mind that very small specimens such as the one he examined are far less contractile on killing than are the adults.

nearly colourless but for the red gills and blood-vessels and, posteriorly, the gut. Others, including specimens from Wasin Harbour, of nearly the same size, were of a light brown colour anteriorly, somewhat darker in the intersegmental grooves, but nearly all the preserved specimens are now practically colourless. One specimen shows mottling of brown pigment anteriorly as far back as the middle of the gill-region.

The prostomium is normally somewhat conical in shape, with a very small notch in its anterior border, though it is deeply grooved below (Pl. XXI. figs. 9 & 10 and text-fig. 62, *b*). In two out of the ten large African specimens specially examined it was, however, as broad distally as at its base, and in two others, as in one of the

Text-fig. 62.



Heads of three specimens of *E. indica*, two of which (*a* and *c*) are of abnormal shape.

The figure shows also variations in the peristomium and in the thickness of the tentacles.

small Maldivan examples, its margin was quite entire. Compare the drawings in text-fig. 62. The eyes are large and of the form of a rounded triangle. The tentacles in all examples are quite smooth, without trace of ringing. The smooth tentacular cirri are remarkably long, extending usually beyond the anterior border of the buccal segment, and in some cases even to the front of the prostomium. These proportions are shown in text-fig. 62 and in Pl. XXI. fig. 9.

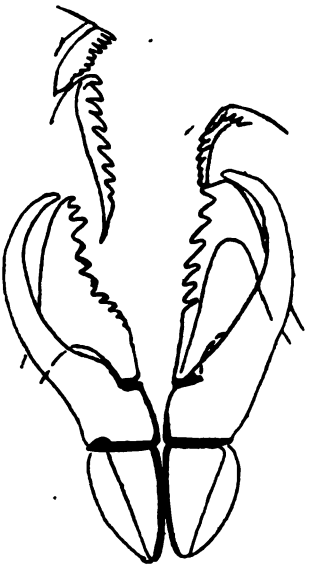
The jaw-apparatus is characterised by the small size, delicacy and calcareous composition of its plates, and by the asymmetry of the great dentals. As in *E. antennata*, *E. vittata*, and certain

others, the posterior left crescentic plate lies alongside and approximates to the size and shape of the great dental. The numbers of the teeth are fairly large, they being especially small and numerous on the crescentic plates. The following formulæ give their variation :—

9— 9 : ? + 7 — ?
10— 8 : 8 + 9 — 13
9—11 : 11 + 10—13
11—11 : ? + 9— ?

The asymmetry of the great dentals exists even when the numbers of the teeth they bear are the same, as was the case in the specimen from which text-fig. 63 was prepared. The lower jaws are almost entirely calcareous in composition and their end-plates are indented.

Text-fig. 63.



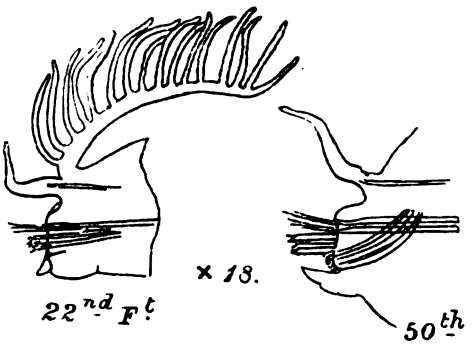
Upper jaws of a full-grown specimen of *E. indica*.

Left anterior plates moved upwards from the natural position.

The feet are comparatively long and slender with long setæ, and are well separated from each other. The dorsal and ventral cirri are well developed, but not annulated. Large gills cover

the anterior third of the body (Pl. XXI. fig. 9), commencing in all these specimens on the third foot, except in the case of three small specimens from the Maldives, in which the first branchiferous foot is the fourth. In fair-sized specimens the gills extend from the 34th up to the 50th foot, and in one case sixteen pairs of rudimentary gills followed this latter point. The maximum number of filaments is from ten to twenty, this variation being normal in large specimens, but one, also of fair size, had gills abnormally small and composed of only seven filaments. In all the smaller specimens the gills are simpler, as mentioned above and as in Gravier's specimen. The setæ are as described by Gravier and other authors, the acicula being simple at the point

Text-fig. 64.



Feet of *E. indica*, showing maximum development of gill.

and slightly bent upwards. The acicular hooks are exactly like those of *E. antennata* and *E. murrayi*, but often occur in greater numbers than ever in the former, the occurrence of four in one foot being quite common. The compound setæ never have a third hook in this species, but the pointed ending of the wing is very characteristic. Figs. 11 & 12, Pl. XXI., illustrate these features and show the difference in the form of the compound setæ from the posterior feet (*cf. a* and *c*).

The most distinctive features of this species are shared by *E. congesta* Marenzeller, from the south of Japan. The differences are that the prostomium of the latter is "moderately deeply indented," the jaw-apparatus shows slight differences in having fewer teeth, and the gills do not appear until the seventh or eighth foot. Such differences are easily accounted for as individual variations, and do not compare at all with the importance of their points of resemblance. The species are alike in the colour and form of the body (so far as these are described by Marenzeller).

the length and smoothness of the tentacles, and every detail of the feet and setæ. The jaw-apparatus shows characteristic resemblances in its yellow colour, in the size and position of the left azygos plate, and in the whole structure and composition of the lower jaws, of which Marenzeller's representation cannot be surpassed as a likeness of the same parts in the present examples of *Eunice indica*.

This extension of the range of the species from the Red Sea to the south of Japan is striking but not without precedent.

EUNICE SICILIENSIS Gr. (Plate XXII. figs. 8, 9.)

Eunice valida, Gravier, *op. cit.*

This highly specialised and almost cosmopolitan species is found apparently wherever limestone suitable for its borings occurs, and so especially in the coral regions of the tropics, where its abundance must be an important item in the list of causes tending to the disintegration of living coral and coral-rock. In East Africa it occurs wherever coral grows, and so is recorded from every locality where I collected, including the shore of Mombasa Island (one small specimen), and from a depth of 10 fathoms in Wasin Harbour, with the notable exception of Chuaka Bay, where no coral occurs. Dr. E. P. Wright brought fragments of a large specimen from the Seychelles in 1868.

In the Maldives, as would be expected from the abundance of soft reef-limestone and growing coral, the worm is very common, being recorded from the following stations:—

Reef and sand-flats of Hulule, Male Atoll; seven specimens and fragments.
North Male Atoll, 25 and 35 fathoms; three specimens.
Minikoi Atoll, from the lagoon sand, three; and from the reef under boulders, two.
South Nilandu, 25 fathoms, hard bottom; one specimen.
Suvadiva, 28 fathoms, from dead coral; one specimen.
From Mahlos Atoll, 20 fathoms, were collected fragments from among sand and rubble.

On splitting a block of growing coral, or blocks formed by recent growth, in very many cases two or three dull green cords stretch across the fissure. There are portions of a specimen of this species, the burrow of which is so long and tortuous as to be cut across two or three times by any split though the block. The burrow has a delicate parchment-like lining, at least in some cases. The worm is also able to burrow in the soft surface of the reef-edge on the east coasts of Zanzibar.

It is remarkable that none of the Maldivan specimens attain to the large size of several of those from East Africa, and the majority of them are about half this size. The largest East African examples measure 5 or 6 mm. in breadth, and such a

specimen would attain to a length of 600 mm. at least, though accurate measurements were rendered difficult by the impossibility of extracting a complete specimen from so long and tortuous a burrow. An incomplete specimen in spirit measured 3 mm. in width and 150 mm. (comprising about 225 segments) in length, and yet none of the gill-region is present.

The colour of the living animal, but roughly noted by Claparède and Ehlers, is somewhat variable. The first third or so of the body-length is of a dirty opaque white, the gill-region is slaty-blue or dull green, a tint which appeared to be due to that of the gut, and finally the posterior part is white again. The tentacles are white, but the prostomium and peristomium are light brown, which tint usually soon dies out. There is often a band of opaque white pigment between the bases of the nuchal cirri, and the brown parts may or may not be covered with small white dots. In a large specimen dredged in Wasin Harbour, the brown coloration, in life, was quite uniform, and extended over nearly the whole of that part of the body which is usually whitish. In some specimens the prostomium and buccal segment are very dark brown, almost black. As noted by Ehlers, the white body-pigment becomes a yellow-brown in spirit; but some specimens, large and small, are now nearly colourless.

A complete account of the anatomy and principal variations of this form may be found in Ehlers's 'Borstenwürmer' and Claparède's 'Annélides du Golfe de Naples.' Grube, in the 'Annulata Semperiana,' remarks on the variation in distribution and size of the gills (which in some of the Philippine specimens were longer than in those of the Mediterranean) and in the proportions of pro- and peristomia, these facts being the same for the specimens from the eastern side of the Indo-Pacific Ocean. Finally, Gravier redescribes the species under the two names *siciliensis* and *valida*; and Ehlers describes very fully a very nearly allied species *E. leucodon* *, giving figures, of which nos. 1, 4, and 10, of the general body form and the lower jaws, serve excellently for this species.

Gravier separates his Red Sea specimens into two species, naming a single small example *E. siciliensis*, while for the rest he institutes the new name *E. valida*. The differences upon which this distinction is based are (1) the length of the gills, which is proportionately about three times as great in the latter as in the former; (2) the proportions of the head; (3) the presence of pigment in the anterior part of the body of *E. valida*. All the specimens seem to have been small, the single colourless *siciliensis* individual having a maximum breadth of only 2 mm. The feet, setæ, and jaws are absolutely identical in both. An examination of the large number of specimens contained in these two collections shows conclusively that these points are variable in the species,

* Polychæten des magellanischen und chilenischen Strandes, p. 128, figs. 1–10.

all stages occurring between the '*valida*' and *siciliensis* types. Indeed, this was noted long ago by Grube in the case of the features (1) and (2), and variations in the colour of living examples are given above. In spirit, colourless specimens are not common, but shades of light and dark brown are numerous.

Gravier's figures (pl. 13. figs. 71–82, and text 130 and 134) are excellent illustrations of the species and the extremes of its variation.

Ehlers's South American species *E. leucodon* differs in (1), as the name implies, the broad white band surrounding the plates of the upper jaw and the almost completely calcareous composition of the lower; (2) the shortness and ringing of the tentacles. The mottling of the body-pigment and other small differences may be found as variations in *E. siciliensis*; but I do not find in these collections any specimens the tentacles of which are shorter than one and a half times the length of the prostomium, or the upper jaw-plates of which are not quite black with but a narrow and inconspicuous white edging. Ringing of the tentacles may or may not be developed. The points of agreement between the two species so preponderate over these small, but constant differences, that it seems best to follow out Ehlers's own suggestion and to regard his specimens as belonging to a local variety of the cosmopolitan species *E. siciliensis*.

Claparède and Ehlers (Borstenwürmer) figure compound setæ with elongated articulated pieces, whereas Gravier's figures (of both varieties) show short triangular hooks as in Ehlers's figures of the *leucodon* variety. These setæ vary considerably, those from anterior segments differing from those found posteriorly in the way shown by figs. 8, *a* & *b*, Pl. XXII., which represent the extremes of the forms met with. Those of the hinder feet are much the stouter, as here commonly one compound seta is found alone. Comb and acicular setæ are entirely absent from all these specimens, even in cases where two acicula occur in a few feet. Their absence forms a very definite distinction between this and others which have simple gills, e. g. *E. schizobranchia* Clap.*, *E. marenzelleri* Gravier†, and *E. cirrobranchiata* McI.‡. These three species indeed show none of the other features of specialisation which make *E. siciliensis* so well marked a form.

Several specimens, *e. g.* four from Hulule, Male Atoll, and one from Minikoi reef, show remarkable papillæ distributed over the three middle tentacles, as shown in fig. 9, Pl. XXII. Possibly these are connected with the "papilles en forme de dômes sur-

* *Op. cit.*, Supplement, 1870, p. 30, and pl. ii. fig. 6. This species has been regarded as synonymous with *E. siciliensis* by later workers. Though Claparède says nothing about its jaw-apparatus and lays emphasis upon probably variable features such as colour and proportions of the buccal segment, the presence of these setæ remains an indubitable distinction of quite specific importance.

† *Op. cit.* p. 230.

‡ 'Challenger' Reports, vol. xii. p. 277. It is remarkable that no specimen of so common and widely distributed a species as *E. siciliensis* occurred in the 'Challenger' collection.

baissés" which Claparède mentions and figures (pl. 2. fig. 5 D). Perhaps these organs are eversible, or have here become hypertrophied.

The means by which the long and tortuous burrows are made are still unknown; the principal suggestions being (1) by aid of an acid secretion, (2) by the mechanical action of the jaws. While in the Maldives, Gardiner repeatedly tested the effect of the bodies of boring annelids upon litmus-paper without finding any acid reaction, a result identical with McIntosh's observations on *Polydora* *. Indeed, it is not easy to see how an acidity of the body could produce any effect beyond enlarging the diameter of the burrow, which is never found larger than the body of the worm it contains. The supposition that an acid secretion aids the action of the jaws is negatived by the calcareous composition of the lower plates, the only parts the action of which could conceivably produce the results seen. The size and gouge-like shape of these strongly suggest their use in cutting out the canal by a rotary motion of the head. The softness of ordinary reef-rock and the porous nature of coral make this hypothesis a possible one.

The mode of life of this species would, if known, be of great interest. Is it usually possible for the head to come to the surface to seek food, or does it, as seems physically necessary, and as is indicated by the absence of gills anteriorly, remain usually at the deep end of the burrow? Can the boring sponges and algæ parasitic in corals afford an appreciable amount of nutriment to the worm?

Genus Nicidion Kbg.

As Eunice *but without gills.*

The species of this genus are but few in number, and several of the names apply to species not yet properly described. Of Kinberg's three species upon which the genus was founded, two are very probably, as Grube notes, specimens of *E. siciliensis*; but the third *N. cincta*, which possesses acicular setæ, is probably a true *Nicidion*, and the shortness of its tentacles indicates the probable identity of this Pacific form with that from East Africa.

The species of which certain identification is possible are but four in number, viz.:—

N. kinbergi H. E. Webster, Bull. U.S. Nat. Mus. 25, 1884.
N. balfouriana McI., 'Challenger Reports,' xii. 1885.
N. brevis Ehl., 'Florida Anneliden,' 1887.
N. edentulum Ehl., Die Polychæten des magell. und chil. Strandes, 1901.

Of these *N. edentulum* is distinguished from all the other species

* Annals & Mag. N. H. ser. 4, vol. ii. p. 276 (1868).

in the character of its jaws, whose structure approximates to those of *Eunice siciliensis*.

NICIDION GRACILIS, sp. n. (Plate XXII. figs. 10, 11.)

Body slender, divided into two parts, which differ in the proportions of their segments and the characters of the feet they bear. Prostomium broad, slightly notched in front; tentacles short, the middle one projecting very little beyond the anterior border of the prostomium. Eyes large, half-moon shaped. Jaws of the usual form, great dental plates with about six teeth each.

Setæ of the usual type.

Allied to N. brevis *Ehl.**, *but differs in slenderness of body, shortness of tentacles, and other characters.*

Three specimens, of which the two largest want the hind end, were dredged in Wasin Harbour.

The body is very slender in proportion to its length, the longest fragment measuring 15 mm. by 1·5 mm., and consisting of sixty-five segments. The single complete specimen is unfortunately undergoing regeneration of the hind end, and so is useless as a comparison. All three are of approximately the same breadth.

In life the anterior half of the body is coloured red-brown by dots of colour on a whitish or pink ground, the posterior part being nearly colourless but for the black gut. In one specimen two white collars were formed by the peristomium and setigerous segments three and four, and a white spot occurred in the middle of each segment just behind the intersegmental groove. In spirit the specimens are a uniform dull light brown, but one is darker and redder anteriorly.

Two of the specimens were infested with a parasitic Syllid, the first by one, the second by seven examples; this species was found also on a Nemertine and a Polynoid, and will be described in due course. The head of the Syllid is buried in the space between two adjacent parapodia.

The head is nearly as broad as the rest of the body, the broadest part of which is about 4 mm. behind it. Both rings of the buccal segment are fairly long, the second being about half as long as the first. These and the next four or five segments are nearly cylindrical in section, but the next twenty-five † are flattened dorsally and especially ventrally, and become very short. These thirty anterior segments form a contrast to the succeeding, both in their own proportions and in the feet they bear (see text-fig. 66, p. 329). The remaining segments are highly arched dorsally, though the ventral flattening extends to the anus, and are from two to three times as long as those of the anterior region. The broadest part of the body is about the middle of the

* 'Florida Anneliden.' Results of dredging by U.S. Fish Comm. SS. 'Blake.' Harvard, 1887.

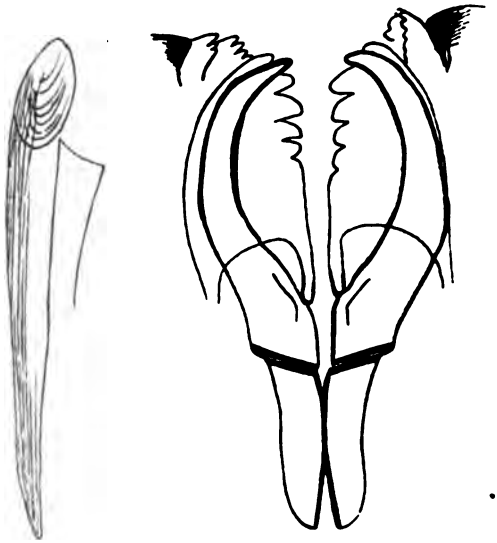
† This number is nearly constant in all three examples.

first region, which narrows slightly to its posterior end, and the rest of the body retains this slightly decreased breadth to near the anus. The figure of the worm (Pl. XXII. fig. 10) gives these proportions and illustrates the differences between the two parts of the body. As here shown, the change is quite sudden at the point given.

The prostomium (Pl. XXII. fig. 10) is nearly as broad as the buccal segment and slightly notched anteriorly in the usual way. The tentacles are smooth, short and thick, the longest projecting but very little beyond the edge of the prostomium. The eyes are large and densely black, of a half-moon shape, or slightly crescentic from some points of view. The tentacular cirri are remarkably small and slender.

The upper jaw-plates are of the usual type, the only noticeable features being the bluntness of the teeth and the length of the supports at the base of the great dental plates. As would be expected from the small size of the worm, the plates are delicate and of a light brown colour, but calcareous matter is not visible.

Text-fig. 65.

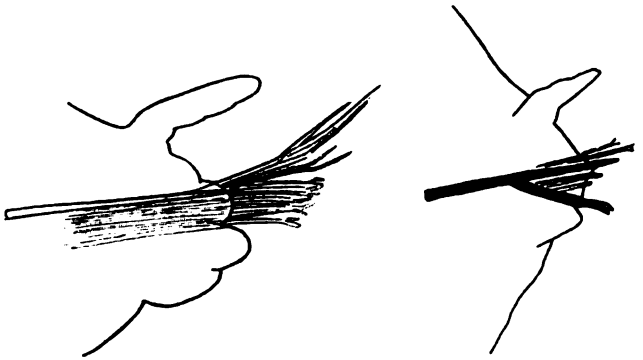


Upper and lower jaw-plates of *Nicidion gracilis*. × 80.

There are two black crescentic paragnaths, one on either side above and exterior to the crescent plates. The lower jaws can scarcely be called plates, they are so delicate and flexible. The shapes of all these parts are shown in text-fig. 65.

The feet of the anterior part of the body project considerably, those of the posterior very little. The former appear to be thicker distally than at their bases, owing to the breadth and thickness of the lips of the seta-sac and to the swelling of the ventral cirri to an egg-shape, the broad end being the distal. The posterior feet are as usual pointed at their tips and have small, scarcely visible ventral cirri. In this way is caused the more striking of the differences between the anterior and posterior parts of the body, the change taking place quite rapidly at the point mentioned, at which also a two-hooked acicular seta first appears. In the anterior feet the dorsal cirrus is long, projecting beyond the end of the seta-sac; posteriorly it is very small (compare the figures of the feet in text-fig. 66).

Text-fig. 66.



Anterior and hinder feet of *Nicidion gracilis*. × 60.

The setæ are numerous and project well anteriorly when not, as is frequently the case, broken off level with the end of the seta-sac. This is the case almost always posteriorly, where usually only a few comb-setæ are found projecting. All are of the usual form and their details are given in fig. 11, Pl. XXII.

There is a single pair of short and slender anal cirri.

This species is very closely related to *N. brevis* Ehlers, from which it is distinguished at once, however, by the slenderness and anterior compression of its body, the shortness of its tentacles, and form of its teeth. The resemblances between the two species are certainly more striking than the differences, comprising the smallness of the tentacular cirri, broad features of the jaw-apparatus (including apparently the remarkable delicacy of the lower jaws), structure of the feet and setæ, and the characteristic differences between those of the anterior and posterior portions of the body.

EXPLANATION OF THE PLATES.

PLATE XX.

Fig. 1. *Eunice afra* (p. 289). Dorsal view of the anterior end of a medium-sized Chuaka specimen. × 3·5.
2. Side view of the same, showing positions of the anterior feet and relations of pro- and peristomia.
3. Outline of head and its appendages of a larger specimen showing the comparatively smaller size of these parts, to same scale.
4. Lower jaw-plates of a young specimen, which are transparent enough to show the structure of the chitinous parts, the calcareous end-plates are well developed. *Cf.* text-fig. 44, p. 293, which is from an older specimen.
5. The bases of the tentacles and eyes, as seen when the anterior border of the peristomium is drawn back. *e.*=eye, *gr.*=groove, *t.*=tentacle.
6. A large complete Maldivan specimen of *E. coccinea* (p. 297), seen from the side to show proportions of body &c. × 2.
7. Lower jaw-plates of a small Wasin specimen (p. 300), showing the characteristic structure of the end-plates.

PLATE XXI.

Fig. 1. *Eunice tubifex*, adult (p. 303). Head and anterior part of body.
2. About segment 85, region of small gills.
3. Region of maximum development of gills.
4. Ventral view of (2) showing secretory pads formed by ventral cirri of the middle part of the body. All the above × 3.
5. Setæ and lips of seta-sac of the 100th foot. × 50.
6. Setæ in detail. *a*, acicular seta from hind body, the guard is broken away as in the majority of cases; *b*, knife-ended compound seta from the 20th foot; *c*, hooked compound seta; *d*, two comb-setæ.
7. The jaw-apparatus of the youngest specimen. × 18.
8. Setæ of a young specimen.
a and *d*, two forms of acicular setæ, from the 35th and 20th foot respectively.
b and *c*, compound setæ.
e, an aciculum.
9. *Eunice indica* (p. 318). Head and anterior end of a full-grown specimen. × 4.
10. Ventral view of the head, showing grooves of the prostomium. Parts of the end-plates of the lower jaws project from behind the border of the prostomium.
11. Group of setæ of the 50th foot *in situ*, showing the relative positions of the different kinds. × 37.
12. Isolated setæ: *a*, compound seta from 80th foot; *c*, compound, and *b*, comb-seta from the 20th.

PLATE XXII.

Fig. 1. *Eunice antennata* (p. 312). Anterior end of a large Zanzibar specimen which was less contracted than usual. × 3.
2. Head of another specimen in which the prostomium and peristomium differ in form from the above and the dorsal cirri are not moniliform. × 6.
3. Ventral view of the head, showing the grooved palps (Chuaka specimen, var. *viridis*). × 8.
4. Lower or mandibular jaws, showing partly calcareous composition &c.
5. An aciculum with bifid distal end. × 280.
6. Compound seta from a posterior foot (the 80th), in which the end-piece has three hooks. × 280.
7. Posterior view of a Chuaka specimen (var. *viridis*), showing large posterior gills, annulated anal cirri, &c. × 10.
8. *Eunice siciliensis* (p. 323). Compound setæ, showing the extreme shapes met with: *a*, from an anterior (5th) foot; *b*, from a posterior foot.
9. A tentacle covered with papillæ distally.
10. *Nicidion gracilis* (p. 327). The anterior and part of the posterior division of the body.
11. Setæ of the same:—*a*, capillary; *b*, compound; *c*, comb; *d*, acicular hook-seta, projecting from foot.

5. Contributions to our Knowledge of the Circulatory System in the Ophidia. By FRANK E. BEDDARD, M.A., F.R.S., Prosector to the Society.

[Received February 4, 1904.]

(Text-figures 67–78.)

So far as I am aware, the detailed accounts of the arteries and veins in Snakes, which have been published by previous observers, are comparatively few in number, though of course a great deal has been ascertained about the more important arteries and veins in a considerable number of types. I have therefore attempted in the following remarks to embody, as briefly as possible, the facts which I have verified in a number of different snakes which have been specially injected with a coloured substance for my purpose. My observations have chiefly been made upon the arterial system, though I am able to add something to our knowledge of the details in the venous system here and there. For the most part the species of snakes which I have examined differ from those studied by previous observers. I have, however, come to the conclusion that a vast amount of work in this branch remains to be accomplished before the knowledge of the circulatory system is at all adequately known in detail. For I find that in the summary given in Bronn's 'Thier-Reich'* the details are not always fully stated, not indeed through omissions to report upon existing literature, but through the absence of great detail in that literature. Many of the older writers, for instance, have only dealt with certain regions of the arterial system. Thus Rathke †, writing upon the single or double condition of the carotid, gives also much information upon the arteries of the head and neck in general; and his account is the completest original account known to me of these arteries, though in Bronn's 'Thier-Reich' it is made still more complete by the incorporation of other work. Brandt ‡ again has concerned himself with the persistence of a ductus botalli joining the carotid and the left arterial aortic arch; while Hochstetter § has figured and described portal veins. The latter authority has compiled an excellent list of previous memoirs dealing with the venous system. The list given in Bronn is also most useful.

In the present paper I attempt to do for a number of different

* 'Klassen und Ordnungen des Thier-Reichs,' Bd. vi. Reptilien, Abth. iii. Schlangen. Leipzig, 1890. The older and well-known works of Meckel, Cuvier, and Milne-Edwards contain a good many facts.

† "Bemerkungen über die Carotiden der Schlangen," Denkschr. k. Akad. Wien, xi. Abth. 2, p. 1 (1856). This memoir has no plates or figures.

‡ "Ueber einen eigenthümlichen später meist obliterirenden Ductus Carotis der gemeinen Kreuzotter *Pelias berus*," Bull. Ac. Imp. Sci. St. Pétersbourg, ix. 1866, p. 274.

§ Morph. Jahrb. xix. (1893).

snakes what Hopkinson and Pancoat * and (more recently as well as more thoroughly) Jacquart † have attempted in the Python, and Gadow ‡ in *Pelophilus madagascariensis*, but with more descriptions of certain details.

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ZAMENIS MUCOSUS.

Intercostal Arteries.—Snakes of this species show a more marked disproportion between the right and left aorta than in the case of *Z. flagelliformis*. The diameter of the left aorta at the point of junction is as nearly as possible 6 mm.; the right aortic at its junction with the left measures barely 2 mm. The left aortic arch gives off no intercostals; from the right arise four, which correspond to successive vertebræ and are therefore close together, leaving a gap posteriorly where there are no intercostals. The first of these arises from the aorta just after it has left the common trunk; the second divides early into two vessels which enter the body-wall side by side; the same is the case with the fourth vessel, but its two branches are here of unequal size. The third vessel at least, if not the others, gives off a branch to the œsophagus. In their bifurcation, and by reason of the fact that they give off branches to the œsophagus, these intercostals resemble those which arise from the anterior vertebral artery. Behind the junction of the two aortas the intercostals are rather different. They may be divided into an anterior and a posterior series, the difference being that those of the anterior series are irregular while those of the posterior series are regularly intervertebral. They are furthermore not concerned with the blood-supply of the œsophagus, the latter being supplied from special trunks arising separately from the aorta. There are 16 intercostals § belonging to the anterior series, which ends at the level of the gall-bladder. The number of vertebræ lying between the points of entrance into the parietes of the successive arteries is as follows:—

I. 8, II. 5, III. 4, IV. 3, V. 2, VI. 4, VII. 6, VIII. 5, IX. 5, X. 3, XI. 2, XII. 2, XIII. 3, XIV. 1, XV. 2, XVI. 2, XVII. 1, XVIII. 1, &c., &c.

Nearly all of these arteries enter the body-wall to the left of

* "On the Visceral Anatomy of the Python (Cuvier) described by Daudin as the *Boa reticulata*," Trans. Am. Phil. Soc. v. 1837, p. 121.

† "Mémoir sur les Organes de Circulation chez le Serpent Python," Ann. Sci. Nat. (4) iv. p. 321.

‡ Incorporated in Bronn's 'Thier-Reich,' *loc. cit.*

§ Perhaps 17 should be assigned to the anterior series.

the dorsal median line. This is the case with the first fourteen; the next two are median in position.

The posterior series of intercostals at the middle and posterior end of the series, where they are most typically developed, differ in a number of characters from the anterior series that have just been described, and agree in many points with the intercostal branches of the anterior vertebral artery. They are (1) paired arteries entering the body-wall to the right and left of the median line; (2) they are regularly intercostal, corresponding to the ribs; (3) they give off branches to the viscera.

There is not, however, by any means a sudden jump from one type of intercostal to the other. The 17th, 18th, and some of the following intercostals (of the whole series, counting from the junction of the aorta) are like the preceding branches, save for the fact that there is one for each vertebra. There are eleven of these arteries, after which the intercostals become paired. The first four of the eleven alternate regularly in their insertion into the body-wall from left to right; the next two are inserted on the right side; the next four again alternate regularly, beginning with the left side; the last of the eleven perforates the body on the right side. The origins of the arteries from the aorta vary in accordance with the point of entrance into the body-wall. Then follow the paired intercostals, of which there are rather over 60 pairs—one twig of the pair being occasionally absent. The absence, however, is rare.

Anteriorly there are many corresponding intercostal arteries, which are, of course, given off from the vertebral artery. Commencing from the origin of the vertebral from the aorta, the first ten trunks are perfectly regular, each one corresponding to a vertebra. The first two branch immediately after their origin from the aorta and enter the body-wall as two tubes; the rest do not, and perforate the body-wall accurately in the middle line. Each of these vessels gives off shortly after its origin a backwardly-running and slender branch to the œsophagus.

In front of the ten regularly-arranged intercostals are two which perforate the body-wall at some distance from each other, so that room is left for six other arteries, which are, however, not developed. Their former presence (?) is indicated by the emergence here and there of an arteriole supplying the œsophagus. The last intercostal is formed by the vertebral artery itself, which plunges into the parietes in the middle line at a distance of $7\frac{3}{4}$ inches from the tip of the snout.

Œsophageal and Gastric Arteries.—The œsophagus and stomach are furnished with a very large number of minute arterial branches, which I do not stay to characterise in detail. Later on these branches become divisible into very minute and rather larger trunks, but it is not until the end of the liver that there is a regular series of fair-sized gastric trunks. None of these, however, nearly approaches in size the two ensuing mesenteric arteries. The failure of large arteries is, however, compensated by the

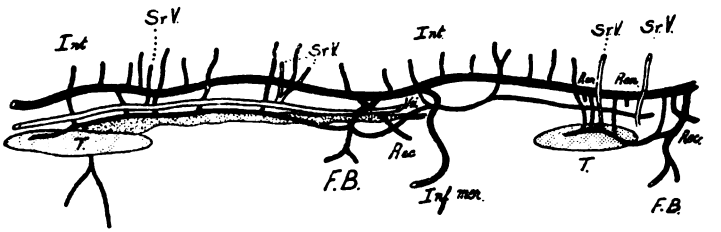
abundance of small ones. From the posterior end of the liver to the mesenteric artery there are 14 gastric arteries, followed by one which, at any rate, chiefly supplies the spleen. There are thus altogether 13 belonging to this series. The first of them is distinctly larger than any of the preceding hepato-œsophageal vessels. These 11 vessels are really arranged in pairs, one of each pair supplying one side, the other the other side of the stomach. The arteries appear to be in reality all of them paired; but the arrangement is lost here and there, owing to the dwindling or total disappearance (?) of one or other of the two arteries making up the pair. Were these invariably present the total of the large-sized gastric arteries would have had to be increased by four. The actual facts of arrangement are these:—The series commences with a pair followed by a single artery, to which, however, corresponds on the opposite side of the aorta a very minute branch. Then follows a pair, the peculiarity of which is that the two vessels arise one in front of each other from the same (right) side of the aorta. The next two are a pair, I believe; but the two arteries arise rather further away from each other than in the case of the previous pair. After this comes a single artery with no fellow that I could see. The next pair also arise some little way apart from each other, but on the same level. Following this is a pair of which the left-hand branch is very minute. The next pair is remarkable for the fact that both trunks arise from a common origin, but shortly after diverge; the last two trunks may be considered to form a pair, but they arise some little way apart, as is the case with the earlier pair of gastric arteries. The posteriorly arising vessel of this pair supplies, as has already been mentioned, the spleen.

Arteries of Intestine.—The 1st, and at the same time the largest, of the arteries supplying the intestine (the shortest, indeed, of all the arteries arising from the aorta) is the *superior mesenteric*. This artery arises exactly opposite the origin of the 7th of the posterior series of intercostals. It passes first of all under* the 9th intercostal portal, and then gives off a forwardly-running branch which very soon divides into two trunks; of these the posterior is the artery of the fat-body, while the anterior runs as far forward as the spleen and pancreas. The main trunk of the mesenteric then passes over the 10th intercostal portal, and gives off a forwardly-running branch, which passes under the main portal trunk and then gives off three branches to the intestine. The main trunk of the superior mesenteric continues its course along the intestine, giving off branches at more or less regular intervals. Ultimately it becomes continuous with the *posterior mesenteric*. This artery arises from the aorta between the 34th and 35th of the posterior intercostals midway between the two testes. It runs to the intestine without branching; arrived at the intestine it divides into two main branches, one of which is continuous anteriorly with the superior mesenteric. The

* *I. e.*, as seen when the snake is dissected.

2nd branch is posterior, and passes back along the intestine to join the first of the rectal vessels. It is perhaps noteworthy that the point of origin from the aorta of the two mesenteric vessels differs; the superior trunk arises laterally from the aorta, whereas the inferior mesenteric arises from that trunk in the mid-ventral line. This conceivably suggests a previous state of affairs (phylogenetically speaking) when the intestine coiled ventrally in its middle and posterior regions.

Text-fig. 67.



Part of arterial system of *Zamenis mucosus*.

F.B., fat-body arteries; *Inf.mer.*, inferior mesenteric; *Int.*, intercostal arteries; *Rec.*, rectal arteries; *Ren.*, renal; *Sr.V.*, suprarenal portal veins; *T.*, testis; *Vci.*, vena cava.

The *first* of the *rectal vessels*, however, originates laterally like the superior mesenteric. It springs from the aorta in a position almost exactly between the two testes and about $\frac{3}{4}$ inch in front of the inferior mesenteric. It has also, as will be mentioned, an intimate relation to one of the arteries of the fat-body (see p. 337). The trunk runs backwards, crossing the inferior mesenteric dorsally, and reaches the intestine at a point about opposite to the end of the first third of the posterior testis. Its behaviour when it reaches the gut is precisely that of the mesenteric arteries; it divides into two branches, an anterior and a posterior, so that it aids in the formation of a continuous sub-intestinal vessel running from end to end of the gut.

The *second Rectal Artery* arises behind the posterior testis, and also springs laterally from the aortic trunk. Moreover, it has exactly the same relations to a fat-body artery arising at this spot as has the anterior rectal.

The *third Rectal Artery* arises laterally (and on the same side as the two anterior arteries) from the aorta just behind the origin of the second of the renal arteries supplying the left kidney. Behind this there are, at any rate, four more arteries arising at much shorter intervals. There may be more, but the injection was deficient in this region of the body and rendered observation difficult. It is noteworthy that the rectal arteries become more crowded towards the end of the body; the 1st and 2nd are further apart than the 2nd is from the 3rd.

Renal Arteries.—The anterior (right) kidney commences at a point about opposite to the middle of the posterior testis. That it is the right kidney seems to be shown by the fact that the renal arteries supplying it arise from the right side of the aorta. It ends about an inch before the termination of the posterior kidney, and is therefore much longer than it. The first renal artery arises from the aorta between the first and second of the testicular arteries; after this follow seven arteries, which do not arise at regular intervals from each other nor opposite to the corresponding branches to the left kidney. The arteries of the left kidney are at any rate eight in number, so that there must be at least a fairly accurate correspondence in the blood-supply of the two kidneys, though I am unwilling to state that it is absolutely accurate.

Testicular and Supra-renal Branches.—The anterior testis is supplied by only a single artery, which is slender and arises from the aorta opposite to about the middle of the testis. It divides at once, on reaching the neighbourhood of the testis, into two branches, one of which runs forwards and the other backwards; the former is the testicular artery, the latter becomes a longitudinal and very slender vessel which runs along the supra-renal body and vas deferens and is joined by other arterioles arising from the aorta. It gives off, however, first of all a branch to the fat-body which has been already referred to. Whether it also gives off small branches to the testis I do not know. This longitudinal artery receives four branches from the aorta, and then joins the main artery to the fat-body, which latter arises from the aorta just behind the origin of the first rectal artery (*cf.* p. 335). On the opposite side it is continued on by a branch arising from this same artery. It is reinforced by a twig arising from the aorta near to the inferior mesenteric and by a small twig beyond this. This longitudinal artery has nothing to do with the blood-supply of the posterior testis, but passes underneath the arteries which run to the latter from the aorta. The blood-supply of the posterior testis is much like that of the anterior generative gland, but with some differences. As with the former gonad, three arterioles arise from the aorta in the region of the posterior testis and join a longitudinal vessel ending anteriorly; this longitudinal vessel receives a branch from the aorta just in front of the second rectal artery, and itself ends in the fat-body artery which comes off from the aorta just behind this rectal artery. The longitudinal vessel is, however, continued by branches of both the two divisions of the fat-body artery as well as from a twig arising from the longitudinal artery in front of the testis. There is, indeed, a kind of rete mirabile among these various small twigs. At the commencement of the kidneys both of the longitudinal arteries accompanying the vasa deferentia end in the longitudinal trunks of the kidneys. From this point, or rather from these points, onwards the vasa deferentia are supplied by branches of the kidney-vessels. Corresponding to the branch which arises from

the artery to the anterior testes for the supply of the fat-body, two twigs are given off from the longitudinal vessel just in front of the posterior testes which also supply the fat-body. This blood-supply has been already referred to in writing of the arteries of the fat-body.

Arteries of Fat-Body.—Each fat-body, which is not particularly well developed, is enclosed in a separate cœlomic space. It reaches from just behind the liver to about the end of the first third of the more anteriorly-situated kidney. The longitudinal artery does not, however, so far as I can ascertain, run through the entire length of the fat-body. The main artery of the fat-body arises from the aorta far back, exactly between the posterior testis and the anterior kidney, just in front and to one side of the posterior rectal artery. It gives off a minute branch, which runs forward and belongs to the system of vessels supplying the vas deferens. It then divides into two equally stout branches, which supply respectively the anterior and the posterior region of the fat-body. The division of the artery takes place some way before it reaches the fat-body itself. The posterior branch ends posteriorly with the fat-body; the anterior branch extends forwards to the superior mesenteric artery which it joins.

The longitudinal artery of the fat-body also receives another strong branch from the aorta in front of the posterior mesenteric and between it and the other testis*. A more slender tributary arises from the first of the testicular arteries supplying the anterior testis, and a second from the region of the posterior testis. The fat-body artery has thus three main origins and two less important ones.

The longitudinal trunk along its course gives off repeated branches to the lobes of the fat-bodies on both sides and also epigastric branches, the number of which will be referred to under the description of the epigastric system. Anteriorly to the origin of the fat-body artery from the mesenteric artery the fat-body is supplied by a series of branches of the various visceral arteries. The longitudinal vein of the fat-body (anterior abdominal) closely accompanies the artery; it finally joins the main portal trunk in the region of the mesenteric artery.

Intercostal Veins of the Portal Systems.—In the anterior region of the body, in front of the heart, there are a series of intercostal veins which pour their blood directly into the heart through the vertebral and jugular veins. In the thoracic and abdominal regions are other intercostal veins, which are connected with the portal system of the liver and of other viscera. The first few, and they are indeed very few, belong to the hepatic portal system. They vary, as do the intercostal arteries, as to the side of the median dorsal line from which they arise. The first six of these vessels arise from the left, the next two from the right side. There are, in fact, only eight of them. The first arises between

* It is noteworthy that the two chief arteries of the fat-body arise on different sides of the aorta.

the 1st and 2nd intercostal arteries; the second accompanies the 4th; the third and fourth the 7th and 8th respectively; the fifth arises between arteries 9 and 10; the sixth accompanies the 14th and 15th. The next two intercostal hepatic portals correspond to the 7th and 10th intercostal arteries of the second series*.

The ninth and tenth parietal veins arise respectively close to the 25th and the 28th and 29th intercostal arteries; the tenth vein is formed by the union of two trunks. These vessels are connected with the testis. They arise from the right side. Some way behind them are two veins for the posteriorly situated testis, which arise from the parietes on the left side of the dorsal middle line.

Blood-vessels of ventral parietes.—These vessels, which are numerous, are of course the equivalents of those of the anterior abdominal system in other Vertebrates. The first of them arises just opposite the 2nd intercostal artery 4 inches behind the heart. Several are accompanied by an epigastric artery, and along the ventral median line lies a continuous epigastric artery and vein of which these are branches. The first 9 of these veins open directly into the liver; they arise from the longitudinal trunk by one root or by several. A strongish arterial twig derived from the arterial plexus upon the œsophagus accompanies the first vein; but the remaining 8 have not at least a well-marked arterial companion. The longitudinal epigastric arteries, moreover, are slender in this region; there are two of them, one running on either side of the median vein; occasionally the artery breaks up into a plexus. Just before the ninth vein the epigastric artery of the right side increases in size and is shortly reinforced by the first of a series of post-hepatic epigastric branches. This first branch is the most prominent of the series. It is not associated with a vein, and divides before reaching the middle line into an anterior and a posterior branch. From the end of the hepatic series to the cloaca I counted 35 veins, which should possibly be reduced by 2, inasmuch as 2 of the veins in question were formed by the junction of two veins each. As to arteries, I counted 24 after the particularly well-developed one to which attention has just been called, and these for the most part were accompanied by veins. The number is probably understated, owing to inefficient injection posteriorly. The agreement with the corresponding veins is often very close, the artery bifurcating at the same time that the vein bifurcates.

Zamenis flagelliformis.

The *right aortic arch* divides, of course, into the aorta and an anteriorly running trunk, the anterior vertebral artery. Of these two branches the vertebral is the more important, and the aortic trunk joins it as if it were a branch entering it from behind, rather than if the vertebral were itself a branch of the aorta.

* See p. 333.

Furthermore, this right aortic arch is a much more delicate vessel than the left aortic arch, which it joins at a point about 10 mm. behind the heart. Just after leaving the common trunk the right aortic arch is crossed superficially by the vertebral vein. The latter is formed of two branches, which emerge from the thickness of the parietes in the middle line and join before crossing the aorta as a single trunk.

Neither the right nor the left aortic arch gives off any branches to the parietes before their union. In the male specimen, however, there were two such branches. The origin of the *anterior vertebral artery* has been already described. It rapidly ascends to the median dorsal line and is lost to sight, becoming imbedded in the neck 2 inches in front of the heart and $5\frac{1}{8}$ inches behind the tip of the snout. It gives off no backwardly running superficial posterior vertebral artery as in *Python spilotes*, but a number of intercostals plunging at once into the thickness of the parietes in the dorsal middle line arise from it. Of these the first is 5 mm. from the junction with the right aortic arch, the next 10 mm. from the first, and the third 18 mm. farther towards the head than the second—*i. e.*, three in all. It also gives off a number of small branches to the œsophagus, which I do not further particularise. In the second individual there were also three intercostals given off from the anterior vertebral artery. It is important to note that this anterior set of intercostals plunge into the parietes exactly in the middle line.

The single aorta is not increased in calibre at the junction and passes back in a more or less straight line; it gives off a very large number of branches, of which the following is, I trust, an accurate account.

There is, in the first place, a series of unpaired intercostal arteries which pierce the parietes along the middle line of the back. Most of these arteries are slightly convoluted, so as to allow of stretching. The first two are at regular intervals of 30 mm. from each other or from the junction of the aortæ; the third arises further away, 40 mm. or so from the second. Closely associated with this is the first of a series of veins emerging from the parietes in a similar fashion, which will be dealt with shortly. The distances separating the origins of the next six branches are 35, 25, 25, 30, 40, and 30 mm. respectively; the 10th is only 10 mm. from the 9th.

The next two complete a series of 12 intercostals, all of which enter the parietes on the left side of the median dorsal line. After this point there is a more or less regular alternation in the point of entrance into the parietes; some of the arteries pierce the body on the right, some on the left. A few, moreover, are strictly paired, and each artery of the pair pierces the parietes either on the right or on the left. There were three such pairs in the specimen examined, all of them towards the end of the series. The total number of arteries which I counted was 46. I do not particularise, since they differed somewhat in the second

specimen. In this, however, the first 11 intercostals pierced the body-wall to the left of the middle line, after which the alternate and occasionally paired arrangement began. The greater distance from each other of the anterior set of intercostals, and the fact that they enter the body on the left side, seem to be distinctive features in this Snake, as in some others.

Visceral Branches of the Common Aorta.—For the first part of its course the aorta gives off a considerable number of minute branches to the œsophagus and to the liver. Passing backwards these gradually grow in importance. They repeatedly branch, the branches become fused so that one may almost speak of a longitudinal system running in the mesentery attached to the liver. The first of the particularly strong branches arises opposite to the eighth of the intercostal branches of the aorta, and also opposite to the posterior end of the liver. The vessel differs from the preceding ones in the fact that it supplies the walls of the alimentary tract and only sends a small branch to the liver, and also apparently to the walls of the large blood-vessels entering the liver; it is thus, so to speak, the first of a new series of branches. The next of these vessels arises 32 mm. further on; it appears to supply the stomach exclusively. The method in which its twigs are distributed to the stomach is as follows:—The vessel when it has reached the stomach immediately bends backwards and runs along the stomach, becoming continuous with the next visceral branch of the aorta. Side branchlets are given off from this common longitudinal trunk. The next visceral vessel arises just opposite to the gall-bladder; when it has arrived at the stomach it divides into three branches. One of these has been already referred to as joining, or rather as in ending in, the previous gastric branch of the aorta; the second branch runs along the surface of the stomach on the opposite side, while the third and shortest branch supplies at least the gall-bladder. The next branch, the superior mesenteric, arises from the aorta 28 mm. beyond the origin of the gastro-splenic. It runs to the stomach in close connection with a vessel from the parietes to the portal vein. Just before reaching the stomach this artery divides into two branches which run in the same straight line; but one is directed forwards, the other backwards along the surface of the gut; the latter runs along the intestine in close association with the portal vein, gives off branches, and finally returns to the aorta, being continuous with the inferior mesenteric artery.

In a second specimen (a male) the gastric arteries are a little different—superficially, at any rate, if not essentially. The last artery occupies precisely the same position, reaching the gut just at the gall-bladder. Although the snake is a rather smaller one, the interval between the gall-bladder and the end of the liver is greater than in the larger snake, about 5 inches to 4 inches. Corresponding to this is a larger number of gastric arteries lying behind the liver. I counted six of them. Each is, with the exception of the third and the sixth, accompanied by an intercostal

portal trunk. In both specimens a single intercostal portal arises near to the penultimate artery of the series. It is plain, therefore, that there is no serious discrepancy of a real character between the gastric arteries in the two individuals. Whether such differences as these are sexual or not I do not know.

Between the superior and inferior mesenteric arteries lie the ovarian arteries. The first seven of these, of varying sizes, supply the fully developed (right) ovary and oviduct. Then follow two arising from the opposite side of the body, which go to the left ovary; finally, a single artery is again concerned with the right oviduct, after which rises the inferior mesenteric. Branches of these genital arteries reach the fat-bodies; but, so far as I can make out, no special arteries supply those organs. There is one important rectal artery which arises shortly after the inferior mesenteric. Between these two arteries arises the first of the renal series, to be referred to immediately. Besides this important rectal artery I found five smaller vessels. The renal arteries are four to the right, and three to the left kidney.

Intercostal Portal Branches.—These are few in number, and I have only mapped them accurately in one (the female) specimen. I counted five altogether, of which four belong to the first series of intercostal arteries. These veins, like the arteries, vary as to which side of the dorsal median line they enter or rather emerge from the parietes. The first two emerge on the left side, the last three on the right. Furthermore, these vessels differ among themselves as to whether they pass below or above the aorta. This position is in absolute correspondence with the point of emergence from the parietes—that is to say, the first two veins pass ventrally of the aorta, the last three dorsally.

ZAMENIS GEMONENSIS.

The anterior vertebral artery is much more extensive in this species than in *Z. flagelliformis*. It extends more than halfway along the neck before becoming lost by plunging into the parietes. In this space a large number of intercostals are given off from the main trunk. I counted 9 in one specimen and 6 in the other; in the latter, however, the vertebral artery itself was not so extensive, only reaching halfway up the neck. In both specimens the right aortic arch gave off three or four intercostals before uniting with its fellow to form the dorsal aorta. It must be noticed that here, as in the last species, these cervical intercostals enter the parietes exactly in the middle line. The intercostals which arise after the junction of the aortæ enter to the parietes either to the left or to the right of the dorsal middle line, or they are paired. The first 20 in one specimen and the first 14 in the other are given off on the left side, and enter the parietes on that side. The difference in number is not great—in one specimen 30, in the other 34 intercostals lie in front of the superior mesenteric. There are 15 intercostals up to the end of the liver in one specimen, 18 in the other.

Visceral Branches of the Aorta.—There are a large number of branches to the œsophagus and to the liver, which I do not particularise. Between the posterior end of the liver and the mesenteric artery there are in both specimens 6 branches of the aorta, which I may term gastric arteries. Of these the last two are the most important. As illustrative of the small range of variation on the arterial system in individuals, I may mention that the number of intercostal arteries arising from the stretch of aorta which bears the six gastric arteries was 13 in one individual and 14 in the other. Immediately after the origin of the superior mesenteric, which branches similarly in both specimens, two intercostal portals arise from the parietes and join the main portal trunk. In both specimens these vessels lie at approximately the same distance from the origin of the superior mesenteric, and of the two the more posterior is the larger.

The next artery which arises is the single artery of the anterior testis; the posterior testis also has but a single artery. In both cases the testicular artery is continued along the vas deferens, where it receives a very slender branch from the aorta a little way behind each testis. The vas deferens of the anterior testis at any rate receives a second slender branch from the aorta, which springs from that trunk some little way behind the point whence is given off the anterior of the two arteries of the fat-body. Moreover, this latter artery gives off a branch to the vas deferens which joins the longitudinal artery running along that duct. A similar branch arises from the second fat-body artery. The fat-body is supplied by two special arteries already mentioned, and anteriorly by a strong branch of the superior mesenteric. They form a longitudinal trunk running along the fat-body.

There are two well-developed intestinal arteries arising posteriorly, of which one, springing just in front of the posterior testicular artery and just below the second fat-body artery, may be called the inferior mesenteric.

Coluber catenifer.

In this species the left aorta is the larger of the two and considerably the longer; it has therefore to follow a sinuous course on its way to the junction with the right and smaller aorta. It gives off several slender branches to the œsophagus. The right aorta gives off two intercostals before its junction with the left.

The common aorta from its origin up to the origin of the superior mesenteric gives off 17 intercostal arteries. They are distributed as follows in relation to the principal alimentary viscera:—In front of the liver there is 1 intercostal, 8 arise along the course of the liver, and the remainder belong to the stomachal region. Corresponding in some degree to these intercostal arteries are a series of accessory portal veins which run from the parietes to the liver directly and of parietal affluents of the principal portal trunk. As to the arteries, they penetrate the

body-wall to one side or the other of the dorsal median line; but there is no regularity in this arrangement—there is, for instance, no regular alternation from right to left. The first 9 intercostals enter the body-wall to the left of the dorsal middle line; the tenth to the fourteenth (inclusive) perforate the parietes on the right side; the fifteenth, sixteenth, and seventeenth revert to the left side. The accessory portal veins are nine in number. As a rule, they accompany somewhat closely the intercostal arteries. The first of them thus accompanies the second intercostal, but before entering the liver it is joined by a branch from the body-wall which lies midway between the second and third intercostals. The remaining vessels are close to their respective intercostals, except the 6th vein, which lies between the fifth and sixth arteries, and the ninth, which has a corresponding position further on. As is the case with the intercostal arteries, the intercostal portal veins are irregular in their origin from the right or left of the mid-dorsal line.

All those, however, which are accessory portals, opening directly into the liver, arise on the left side, as do the four following intercostal affluents of the portal vein. The fourteenth vessel of the whole series is on the right side. This vessel, moreover, appears to be the last of the parietal portal system. It lies well in front of the origin of the mesenteric—in fact, a little behind the commencement of the narrow pyloric region of the stomach.

The *anterior vertebral artery* becomes lost in the parietes 4 inches beyond the heart and 4 inches from the tip of the snout. It gives off 7 intercostals at not regular intervals; these are accurately median in position.

The *artery of the fat-body* receives from the aorta only one important affluent which belongs almost entirely to itself. This artery arises from the aorta between the two testes, and, after giving off a very slender twig to the vas deferens of the anterior testes, supplies the fat-body. Anterior branches of the gastric artery supply the fat-body.

This Snake has an unusually extensive system of *gastric arteries*. I counted 15 of them altogether. The first artery supplies one side of the stomach and the second the opposite side. The remaining arteries show with some irregularity the same alternation. The tenth gastric artery sends off two slender twigs backwards for the supply of the pancreas and adjacent viscera. It also gives off a backwardly running branch which joins the gastric branch of the superior mesenteric and also divides into two trunks, one for each side of the stomach.

The next artery for the supply of the viscera which arises after the gastric is the *superior mesenteric*. This artery has the usual two branches; but before it divides into these it gives off a slender forwardly running branch to the pancreas and spleen. This branch runs to the left of the portal vein, while the gastric branch runs to the right of the same vein.

The *spermatic* and *renal* arteries have no definite relations to

each other. They (the artery to the fat-body, the inferior mesenteric, and the first intestinal) arise in the following order:—(1) anterior spermatic; (2, 3, 4) three arteries to vas deferens; (5) fat-body artery; (6) first right renal; (7) posterior spermatic; (8) inferior mesenteric; (9) second right renal; (10) artery to vas deferens; (11) first intestinal; (12) first left renal (with branch to vas deferens); (13) third right renal; (14) second left renal; (15) fourth right renal.

The left kidney has in all 8 arteries and the right much the same, though I cannot be so precise.

Coluber melanoleucus.

Anterior Vertebral Artery.—This artery is more extensive in this species than it is in many Snakes. It runs up to the neck to within an inch of the head, where it becomes lost in the thickness of the parietes. It gives off a number of intercostal branches, which are exactly median in their entrance into the dorsal parietes. The nine anterior arteries of this series appear to me to be regularly intercostal and each to correspond to a vertebra. After this point the arrangement is not so regular. Between this point and the origin of the vertebral artery there were only 8 intercostals and 1 very minute one. It may be remarked that where the intercostals are regular in their arrangement they are to a large extent smaller than those arteries set at irregular intervals.

Intercostal Arteries.—The right aorta before it joins the left gives off but a single intercostal, which perforates the body-wall to the left of the dorsal median line. The intercostals which arise after the junction of the two aortæ are not so numerous anteriorly as they become posteriorly; and, furthermore, these anterior arteries perforate the body-wall to the left of the middle line. Only ten of these arteries arise from the aorta up to the posterior end of the stomach, and they all of them enter the parietes on the left side of the dorsal median line. From this point onwards there is an irregularity and alternation in the place of entrance of the intercostals. The 35 or so of them which arise from the posterior section of the aorta are obviously more crowded together than the anterior set. A few of them are strictly paired.

Gastric Arteries.—The arteries supplying the stomach are apparently 11 in number, of which the first six are insignificant in size, and the ninth is the largest. They are all concerned with the feeding of two longitudinal trunks which run along the surface of the stomach, and have a markedly undulatory course with the loops closely approximated to allow, of course, of the distention of the stomach without injury to themselves. These arteries, which arise from the aorta, are given off in alternating positions, according to whether they debouch into the right or the left longitudinal trunks. The first of the

series supplies the right side and also sends back a large branch to the liver. The alternation is kept up with perfect regularity until the ninth and largest of the series, which, immediately after its origin from the aorta, divides into two vessels, each of which supplies one only of the longitudinal gastric trunks. The same is the case with the tenth vessel, which is also concerned with the blood-supply of the gall-bladder. The eleventh arises opposite the gall-bladder and runs over it. Immediately after the gall-bladder arises the very large mesenteric vein, which is really almost as thick as the aorta. It runs down the intestine, giving off branches to the same. The first branch is much the largest and supplies the gall-bladder, spleen, and pancreas. I could not find any gastric branch to this artery and feel assured that if such a branch exists, which might I admit be expected, it is not large. It looks to me very much, in fact, as if the superior mesenteric artery in this snake had retained its original derivation from two separate trunks, one gastric and one intestinal, and that therefore the last gastric which crosses the gall-bladder really belongs to it.

Ovarian and Oviducal Arteries.—As is usual in the Ophidia, the arteries to the gonads come between the superior mesenteric and the remaining arteries of the alimentary tract. The first of this series of arteries is the anterior ovarian artery, which opens into a longitudinal artery running down the gonad. Separated from this by five intercostal arteries is a much larger vessel which supplies the oviduct belonging to that ovary and the fat-bodies; its mode of distribution to these two organs is rather curious. It divides almost immediately into trunks, roughly equisized, which pursue a tortuous course at right angles to each other, the one anteriorly and the other posteriorly. The former reaches the oviduct and forms a longitudinal vessel running along the oviduct and giving off numerous branches to the lobules of the fat-body.

The posterior branch seems to be entirely concerned with the blood-supply of the fat-body; it forms a longitudinal trunk and gives off numerous branches right and left.

Very close to this trunk and behind it arises the second ovarian artery. The oviducal artery lies much further back and is separated from the ovarian artery by two intestinal arteries and two renals belonging to the anterior kidney.

Intestinal Arteries.—I observed only two of these, but there may be others posteriorly, where the injection had failed. It is noteworthy that in this species, unlike what is found in some others*, the first intestinal artery, which we may term the inferior mesenteric, immediately follows the gonad arteries and precedes the renal. The rectal artery lies next to the second renal artery of the anterior kidney.

Renal Arteries.—Here, again, I am unable to give full details. I can only say that two renal arteries of the anterior kidney arise

* E. g., *Naia tripudians*.

in front of the first renal artery of the posterior kidney and that the second of these arteries branches into three before entering the substance of the kidney.

Tropidonotus fasciatus.

In this Snake the anterior vertebral artery is exposed for the greater half of the distance which lies between the heart and the posterior end of the head. In the two individuals I have examined it gives off only three intercostals, which occupy about the same position in both. Besides these, the larger—female—(which is perhaps rather better injected) shows a few very minute intercostals with interspaces between the larger trunks. That individual, moreover, possesses a vessel of rather peculiar origin and distribution, which I could not find in the other snake—a male—throughout its whole extent. The artery is a fairly large one and arises from the dorsal side of the vertebral between the last two intercostals, and passing along the wall of the œsophagus enters the parietes anteriorly to the left of the middle and some way in front of the disappearance of the vertebral artery. It may be added that the vertebral artery gives off branches to the œsophagus, as do the carotids, and that some of these spring from the intercostals.

Intercostal Arteries and Veins.—There is only a single vertebral artery given off from the right aorta before its junction with the left. Thence forward follows as usual a considerable series of trunks, of which *all enter the body-wall accurately in the middle line* as fixed by the disposition of the tendons in this region of the body. There are nine of these up to the origin of the superior mesenteric artery: the first lies in front of the liver; five arise along the course of the liver, and three are posterior to it. The corresponding portal veins do not invariably rise from the parietes in the dorsal median line. The first of the portal series accompanies the second intercostal, but arises from the left side of the dorsal middle line; it receives a small branch which arises from the parietes nearer to the head, and also much further away from the dorsal median line. The second portal is the stoutest trunk of the series; it arises to the left of the middle line between the third and fourth intercostals. The next portal is a very fine and slender tube arising in front of the fourth intercostal and also to the left side. Then follows a complex parietal portal consisting of three trunks, of which two are in front of and one behind the fifth intercostal. They all lie to the left of the dorsal median line at their point of origin, the third branch more so than the rest. From the latter a slender twig is connected with an equally slender tube arising in this case to the right of the median dorsal line. The next portal trunk is a fairly important one; it arises in front of the seventh intercostal and to the right side; it is formed by a slender anterior trunk which arises in a corresponding position further forward. The next two portals are of fair size and arise one a little in front of and the other a little behind

the eighth intercostal and again on the right side. The common trunk formed does not enter the liver directly, but joins the portal vein. This is also the case with the last of this series of portals, which arises, also to the right of the median line, just behind the ninth intercostal. The following parietal portals are connected with the suprarenal bodies.

In the second and male individual there are some differences in the arteries and veins in question. There are two intercostals in front of the junction of the aorta and twelve between this point and the origin of the superior mesenteric. All the arteries, however, are exactly median in position where they perforate the body-wall. There are nine or ten portals arising from the left side which extend down to a point about opposite to the end of the liver. I cannot give an accurate description of how some of them join each other before entering the liver. After these, six trunks arise on the right side, each three forming a single trunk. The last of these vessels joins the portal vein before it reaches the liver.

From the origin of the superior mesenteric artery to the cloacal aperture there are 16 vertebral arteries, all of which, as before, perforate the body-wall in the dorsal median line. The arrangement of these is peculiar, in that they alternate in their points of origin from the dorsal aorta. This obviously suggests an originally paired series which have been pulled asunder in an antero-posterior direction by the lengthening of the body.

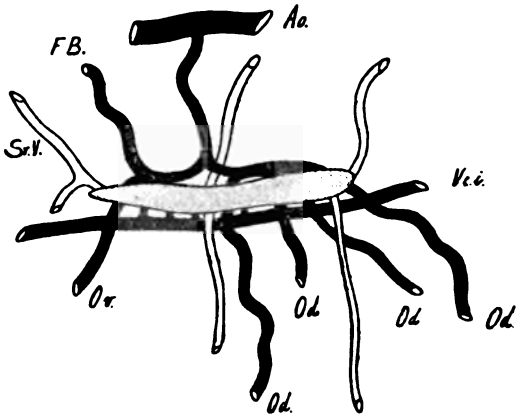
Œsophageal Branches.—The œsophageal branches are all very slender and fairly numerous. The section of œsophagus which lies in the fork formed by the right and left aorta is supplied from three distinct sources. There is, first of all, a slender artery which emerges from the body-wall in company with a vein to the right of the middle line. Anteriorly there are one or two similar arteries which may emerge from the middle line. The chief blood-supply, however, of this part of the œsophagus is from two vessels arising from the right aorta, between which arises a third branch supplying part of the œsophagus behind the junction of the aortæ. The left aorta provides two branches, one arising near its commencement, and another which is very inconspicuous and given off not far from the junction with the right aorta. After the junction of the aortæ and before the beginning of the liver I counted four œsophageal arteries.

In the region of the liver the same arteries supply both liver and œsophagus or stomach as the case may be. There are 8 of these arteries, which increase in length and strength towards the stomach. These 8 arteries are followed by one which serves the stomach and the gall-bladder, spleen, and pancreas only. It is the single gastric artery, and indeed it practically supplies the stomach only, the twig to the other viscera being excessively minute; these viscera are, in fact, cared for by the superior mesenteric. This vessel, as usual, has two main branches—an intestinal and a gastro-splenic. But before its division into these

two branches, just at its origin, in fact, from the aorta, a moderately short branch is given off which very soon divides into two, one running to the spleen, the other to the ovary. In the male *Tropidonotus fasciatus* this branch was entirely absent. The inferior mesenteric springs from the aorta in both sexes close to the second gonad artery, in front of it in the male, behind it in the female. There are 4 well-developed intestinal arteries in the female, of which the last supplies the rectum; beyond this are a few of less importance.

Ovarian and Oviducal Arteries.—There is no independent artery to the anterior ovary; it gets it blood-supply from arteries which also supply the oviduct; and from the same branches arise twigs for the supply of the fat-bodies. As is the case with other organs, a longitudinal system of blood-vessels is developed, which are fed by branches of the aorta. A longitudinal artery runs along

Text-fig. 68.



Ovarian and oviducal arteries of one side of the body in *Tropidonotus fasciatus*.

Ao., aorta; *F.B.*, fat-body artery; *Od.*, oviducal arteries; *Ov.*, ovarian arteries; *Sr.V.*, suprarenal veins (left white), suprarenal body shaded.

the ovary and another of greater calibre along the oviduct. The two are in communication by transverse branches. Of these branches I have counted 7, the last four being the larger and corresponding, together with branches arising behind the ovary, to that section of the oviduct which contained no less than 10 mature ova. The middle artery of the seven is much the largest and is a direct continuation of the artery arising from the aorta, which in other Ophidia supplies mainly, if not exclusively, the gonad. Here, as will have been seen, the main branch is to the oviduct.

The longitudinal ovarian vessel is also in communication by

transverse trunks with the fat-body; posteriorly to the ovum the longitudinal artery of the fat-body is fed by branches of the oviducal artery. It is important to notice that anteriorly the three longitudinal arteries, which have just been referred to, spring from separate branches of the superior mesenteric*. What should be, so to speak, the ovarian artery is, as usual, the first artery after the superior mesenteric to spring from the aorta. The arrangement of the arteries and veins in this region of the body is illustrated in the accompanying drawing (text-fig. 68, p. 348). The ovarian artery, as we must call it, runs straight towards the middle of the suprarenal body. Arrived at the edge of that body it divides into two branches, of which the anterior forms the longitudinal vessel of the ovary and almost immediately gives off a stout branch to the fat-body. The posterior branch supplies the oviduct, to which it gives off four branches, of which, as has been already mentioned, the first is the stoutest. The next visceral artery to arise from the aorta is the oviducal artery—of course, of the anterior oviduct. It passes slightly backwards after its origin and then runs forward to near the last of the oviducal branches of the ovarian artery; it then gives off a minute branch which is continuous with the longitudinal system of the ovary and bends sharply back pursuing a posterior course. Immediately after bending it gives off an artery to the fat-body, at least another arteriole to the ovarian longitudinal artery, and divides into two equally sized oviducal branches. Nearer to its point of origin from the aorta, the oviducal artery gives off two branches to the more posterior region of the oviduct. The first of these gives off an artery to the fat-body before dividing into two branches; the second does not give off such an artery. After the oviducal artery the aorta gives off two vessels situated exactly opposite to each other.

The right-hand one of these runs parallel with the oviducal artery and actually emits one or two arterioles which convey blood to the oviduct. The main trunk, however, supplies the fat-body. There are other trunks supplying the anterior oviduct which will be dealt with in the order of their origin from the aorta†. The next trunk to be considered is the second ovarian artery. This artery in many ways repeats the conditions observable in the anterior ovarian artery. It arises from the aorta exactly opposite to the fat-body artery just described, than which it is of course much stouter. Arrived at the edge of the suprarenal body it divides into an anterior and posterior trunk; the former is the longitudinally running ovarian artery which gives off numerous small branches to the ovary itself, as well as a number of large trunks to the oviduct. The posterior branch repeats almost exactly the conditions observable in the oviduct of the anterior ovary. It gives off one branch immediately, which is soon followed by three others; there are thus four in all, as with the anterior oviduct. The main difference is that none of these

* See the description of that artery, p. 347.

† In connection with the renal arteries: see p. 350.

vessels gives off branches to the fat-body. The posterior suprarenal body, I may remark, receives only one portal branch, in which it differs from the anterior suprarenal.

The oviducal artery of the posterior oviduct arises after the inferior mesenteric (which immediately follows the ovarian artery) and the first renal artery. Its origin is distinctly from the left side of the aorta, as is that of the ovarian artery; this position is marked by the median ventral origin of the inferior mesenteric. The first branch given off joins the longitudinally running ovarian artery; about halfway between its origin from the aorta and the oviducal walls a stout branch arises which goes, I believe, to the fat-body *. The artery then passes straight to the longitudinal artery of the oviduct, without giving off anything more than very minute branches.

The second oviducal artery arises at the same distance behind the third † intestinal artery as the first oviducal artery is behind the inferior mesenteric. The peculiarity about this artery is that as it turns round the anterior end of the posterior kidney it gives off a branch to that organ. Thereafter follows a series of arteries which are the renal arteries, though they largely give off branches to the oviduct; they are dealt with below. Behind the kidney a series of small vessels arises from the aorta to supply the walls of the oviduct; similar vessels arise on the opposite side of the aorta and supply the other oviduct.

Spermatic Arteries.—Of these there are only two, one for each testis. The anterior testis is considerably the larger gonad. The artery of the anterior testis is the first visceral artery after the superior mesenteric. Before reaching the suprarenal capsule it gives off a strong branch which runs dorsally of the testis to the fat-body. It forms a longitudinal artery running along the suprarenal and the testis, which is posteriorly continued along the vas deferens. Anteriorly the spermatic artery branches into a few slender tubes which are lost on adjacent mesenteries and possibly also supply the fat-body. The suprarenal receives two portals, one at each end—exactly as does the corresponding suprarenal of the female snake. Similarly the posterior suprarenal has only a single portal vein. The second spermatic artery does not give off any well-marked branch to the fat-body; but there may be slender twigs.

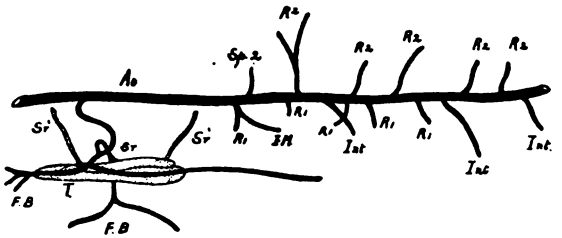
Renal Arteries.—The renal arteries of the anterior (right-hand) kidney are largely mixed up with arteries supplying the oviduct, indeed all the renal arteries provide branches for that region of the oviduct which lies opposite to the kidney. There are four of them altogether, of which the first is rather farther apart from the others than they are from each other. The first of these arteries springs from the aorta between the inferior mesenteric and the oviducal artery of the posterior oviduct. Arrived at the edge very near to

* The fact that the artery had accidentally been broken does not allow me to speak positively.

† Reckoning the superior mesenteric as the first.

its anterior boundary, this artery divides into three. The outer one bends round the anterior end of the kidney and, after giving off two small branches to the kidney-substance, goes to the oviduct; the second branch crosses the kidney, gives off a branch to the kidney-substance, and then passes on to the oviduct; the third branch forms the longitudinal renal artery which runs along the inner margin of that organ. The ureter and the afferent renal vein which lie on the flat ventral surface of the kidney receive a branch from a vessel which arises from the longitudinal renal trunk between its first two affluents from the aorta. The second renal artery divides into two branches just before reaching the edge of the kidney which form the longitudinal renal vessel; the anterior branch gives off a vessel which crosses the kidney, and, after giving off a branch to the longitudinal trunk running down the ureter,

Text-fig. 69.



Spermatic and neighbouring arteries of *Tropidonotus fasciatus*.

Ao., aorta; *F.B.*, fat-body arteries; *I.M.*, inferior mesenteric artery; *Int.*, intestinal arteries; R^1, renal arteries of right kidney; R^2, do. of left kidney; *Sp.* 2, spermatic artery of left testis; *Sr.*, suprarenal body; *Sr.'*, suprarenal portal veins (left white); *T.*, right testis.

becomes an oviducal artery; some little way before reaching the oviduct it sends back two branches to the ureter. The third renal artery as well as the fourth supply the kidney-substance, the longitudinal renal artery, the ureter, and the oviduct. A little way beyond the end of the kidney the ureter receives a special branch from the aorta. Beyond this, again, a special branch supplies the oviduct. The left kidney is supplied by arteries whose arrangement is much that of those of the opposite kidney. There are four of them altogether. The first artery is, as has been also mentioned elsewhere, mainly an oviducal artery. Arrived at the kidney this vessel emits a strong branch which is the beginning of the longitudinal artery of the kidney; a little farther on, as it curves round the end of the kidney, it gives off one or two small branches which plunge into the substance of the kidney.

The second renal artery arises from the aorta behind the third renal artery of the opposite kidney. It is purely renal in distribution and gives off no branch to the oviduct. The third and

fourth renal arteries, on the other hand, both give branches to the oviduct. I should add that in this kidney, as in the opposite one, there is a longitudinal system running along the ureter as well as along its inner border.

In the male, the first renal artery arises just in front of the second spermatic artery and just below the inferior mesenteric; the second artery of the anterior kidney arises next. Then follows the first artery of the posterior kidney, which gives off a stout branch supplying (I think) the fat-body. Each kidney has in all five arteries.

Coronella getula.

The *anterior vertebral artery* is extensive in this species and does not plunge into the parietes until farther than halfway up the neck. Exactly at its point of origin from the aortic arch, where naturally an angle is formed—in fact, exactly bisecting the angle in its line of direction,—arises the first of the intercostal branches of the vertebral. The lymph-tube surrounding

Text-fig. 70.

Zamenis flagelliformis.

Origin of right aorta and other arteries, to illustrate mode of enclosure within lymphatic sheath.

L.Ao., left aorta; *R.Ao.*, right aorta; *X*, lymphatic vessel not containing an artery.

the artery here dilates into a sac, which completely envelops the intercostal artery in question. The structure is rather different from that seen in an example of *Zamenis flagelliformis*. In the latter there is a dilatation at the junction of the

aorta and vertebral artery, but a special lymph-tube ensheathes the outgoing intercostal artery, and beside it another lymph-tube (see text-fig. 70, p. 352) which does not contain an artery, but whose presence possibly indicates the former existence of such an artery. Traced anteriorly, the vertebral artery gives off a branch to every intervertebral space. Some of these, however, are excessively fine and might readily be missed. There are fourteen, however, which are stout arteries and could not be missed, which lie between the origin of the anterior vertebral and the point at which it disappears into the thickness of the parietes. It is interesting to note that none of the intercostal branches seem to be really missing; they are simply unequally developed. All these arteries are exactly median in their point of entrance into the parietes, and a clean-cut circular orifice in the parietes considerably larger than the artery permits its passage. The right aortic arch gives off two intercostals before it joins the larger left aortic arch. As is the rule in the Ophidia, the intercostals in the anterior region of the "thorax" are much less numerous than they are posteriorly. But here there are not indications, as there are in the cervical region, of missing intercostals. This suggests the length of the trunk is an older feature of the Ophidia than the length of the neck.

This snake differs from some others in the fact that the bulk of the intercostal arteries beginning quite anteriorly divide near to the dorsal middle line, so that the entrance into the parietes is on both sides of the vertebra. The very first of the intercostals, and after two others which are single and enter on the left side, is another which bifurcates; thereafter follows a series which regularly bifurcates. Further back the usual and irregular alternation of the arteries is to be noted. As this more or less regular bifurcation of the anterior intercostal arteries occurs in both specimens, it may fairly be regarded as typical of the species.

Gastric Arteries.—The gastric arterial system in this snake shows certain broad differences from that of *Coluber melanoleucus*. It is possible in the first place to distinguish two series of gastric arteries, small and large. This is not simply a question of larger posterior and smaller anterior gastric arteries, such as occur in *Coluber*. In *Coronella getula* there are a few large arteries which vary somewhat in size among themselves, and a host of minute arteries of almost microscopic size. There is no series of transitions between the minute and the large arteries; the latter lie among the former. The minute arteries form a complex network in the mesentery of the stomach, though with very large meshes, and end upon the surface of the stomach. This network appears to join the trunks of the larger gastric arches.

Of the large gastric arteries there are five, of which the first and the last are not purely gastric but also supply other organs.

The first gastric artery arises just at the junction of the œsophagus and stomach, and just at the end of the liver. It is much larger than the preceding hepatic arteries, so that there is

here a distinct break. Immediately after its origin, this artery gives off a branch to the liver. After crossing the portal vein, the artery divides into two branches, one of which runs to the œsophagus and the other pursues its course towards the stomach, and when it reaches that organ again divides into two—an anterior and a posterior branch. The latter is continuous with a trunk running in a sinuous course along the left side of the stomach from end to end, and which is connected (as will be mentioned presently) with other gastric arteries arising from the aorta. From where it crosses the portal vein this artery is accompanied in all its branches by a portal trunk.

The second gastric artery is purely gastric. It runs straight to the stomach, and there divides into an anterior and a posterior branch. These together form a longitudinal gastric artery running along the right side of that organ. This artery is also accompanied by a portal vein; and as it arrives at the portal vein a branch from the body-wall enters at a point nearly opposite. This trunk from the dorsal parietes arises from two roots which unite after passing the dorsal aorta. The third gastric artery is much farther away. The interspace is occupied by a parietal branch of the portal, which arises by a single root only, and by a gastric branch of the same. This suggests a missing gastric artery, as the correspondence between the gastrics and portals is so great in this species; but it is to be admitted that there is no further evidence respecting it.

The third gastric artery is the most important of the series. Unlike the preceding arteries, it supplies both of the longitudinal gastric arteries. It is accompanied by branches of the portal system. The fourth artery is more slender; it does not seem to be connected with the longitudinal systems arising from the preceding arteries. The fifth artery is not exclusively gastric. It is, in fact, a branch of the superior mesenteric. This branch immediately divides into two trunks, one for each side of the stomach. The first branch, that given off nearest to the aorta, joins the third gastric artery; the main branch contributes to the longitudinal trunk of the stomach, which is connected with the first and with the third gastric artery.

In the second specimen the arterial system of the stomach only appeared to differ in the absence of the fourth gastric artery, which is slender and unimportant in the first specimen. As in that specimen, the third gastric is by far the most important artery, and it supplies in the same way both sides of the stomach.

Intestinal Arteries.—Of these, the first and most important is the *superior mesenteric*. The artery arises from the aorta just opposite to the end of the stomach, as is usual. The next artery, which I call the *inferior mesenteric*, is very much further back, and arises from the aorta opposite to about the end of the first third of the anterior kidney. It arises dorsal of the 2nd testicular artery. After this I counted four rectal arteries in one specimen (the female).

Genital Arteries.—It is remarkable that both the ovary and testes, in spite of the disproportion of their size, are each of them furnished with a single artery only; that is to say, of course, there is a separate artery to each ovary and to each testis. The artery supplying the anterior testis is the first artery which springs from the aorta after the superior mesenteric; it is closely accompanied by a parietal portal vein. Then follow six arteries which supply the vas deferens and the suprarenal. But of these six, the first and the last but one are mainly (perhaps really exclusively) fat-body arteries. After them arises the artery of the second, posterior, testis; this is given off close to the inferior mesenteric. I am uncertain how many arteries supply the vas deferens of this testis. Three parietal portals lie among these vas deferens arteries.

The ovarian and oviducal arteries are very similar in their arrangement. The artery of the anteriorly-situated ovary is also the first artery to spring from the aorta after the origin of the superior mesenteric, but it is placed farther forwards than in the case of the testicular artery. It is closely accompanied by a branch of the portal; it is followed by two oviducal arteries, of which the second gives off a large branch to the fat-body. Near to each of them is a parietal branch of the portal. Then comes the ovarian artery of the posterior ovary. This is followed by two oviducal arteries; after which comes the second fat-body artery. This is again followed by two oviducal arteries, between which lies a parietal portal vein. All these arteries lie in front of the inferior mesenteric, which is the next artery to follow.

Ophiophagus bungarus.

In this species the much shorter left aortic arch gives off five quite slender vessels to the œsophagus before it joins the right aorta. The latter, at the point of junction, is about one-third of the diameter of the former.

The right aorta gives off four intercostals before it fuses with the left arch. These intercostals agree with the entire series in perforating the body-wall in the middle line. This state of affairs is apparently without exception, and is thus characteristic of the species, as it is of *Lachesis gramineus*. There are about 80 of these arteries* from the junction of the aorta to the end of the body; they are, as usual, given off at irregular intervals, sometimes closer, sometimes further apart. Below the muscles each artery divides at once into a right and left branch.

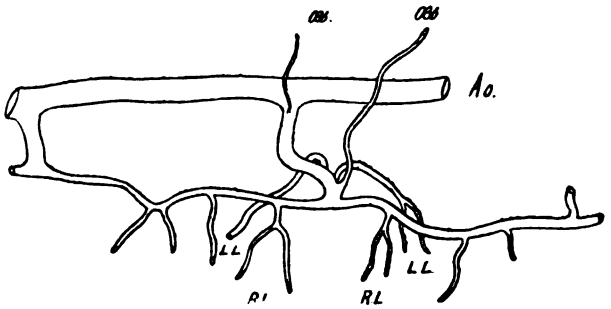
The anterior vertebral runs up the neck to within an inch of the head, giving off median intercostals; these are very nearly one to each successive vertebra, but the arrangement is not quite regular.

I counted 24 arteries supplying the œsophagus and liver,

* I cannot be certain to two or three, as the injection was deficient posteriorly.

which arise at fairly equidistant intervals of about an inch. The two lobes of the liver are served by different arteries, all of which spring from a continual longitudinal hepatic artery which runs between the œsophagus and the liver. The exact arrangement of these branches in the case of one artery is shown in the accompanying drawing (text-fig. 71), and the others do not differ greatly.

Text-fig. 71.



One of the hepatic arteries of *Ophiophagus*.

Ao., aorta; *L.L.*, branches of hepatic artery to left liver-lobe; *œs.*, œsophageal branches; *R.L.*, branches of hepatic artery to right line.

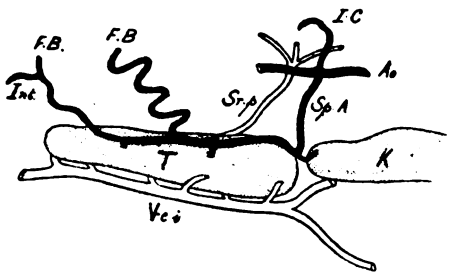
The superior mesenteric artery arises a little behind the gall-bladder, and divides into the usual two branches—one gastric, the other intestinal. The inferior mesenteric arises just behind the anterior spermatic artery. It crosses the anterior kidney ventrally, and gives off a branch to it on the way. After this artery there are 5 intestinal arteries. The next to the inferior mesenteric arises behind the anterior kidney. The four following arteries are somewhat crowded together. In addition to these, some of the renal arteries give off branches to the intestine.

Gastric Arteries.—Six arteries arise from the aorta after the end of the liver and supply the walls of the stomach. Five of these are fairly close together and at the anterior end; the sixth is much further away, though not quite halfway between the fourth gastric artery and the origin of the gastric branch of the superior mesenteric, which may be regarded as a seventh gastric artery. These arteries combine to form two longitudinal vessels running along the stomach, which practically commence with the first of these arteries, though slender anastomoses exist anteriorly. I call, in fact, that artery the first of the gastric series which begins the longitudinal arteries and has at least no marked branch to the liver. It may furthermore be pointed out that the six purely gastric arteries pass ventrally of the portal vein, while the gastric branch of the superior mesenteric lies dorsally to that vein. The first two gastric arteries divide into

two trunks, of which one runs straight forward to the further side of the stomach, while the other branch immediately divides into two main branches which supply the nearer of the two longitudinal gastric arteries; these also give off arteries to the fat-body. Arteries 3 and 5 cross the stomach and pass at once to the further of the two longitudinal arteries; there is no branch to the nearer. The 4th and 6th are like the 1st and 2nd, in that they supply both the gastric longitudinal vessels. The 6th artery is not markedly larger than the 4th. The gastric branch of the superior mesenteric divides into two trunks, each of which supplies one of the two longitudinal trunks of the stomach. It is to be noted that the spleen, gall-bladder, &c. are not supplied with blood from the last gastric artery, but only from the superior mesenteric. This contrasts with the condition observable in some other snakes.

Spermatic Arteries.—There is but a single spermatic artery to each testis. The first of these is the first visceral branch of the aorta after the superior mesenteric. It reaches the testis at its

Text-fig. 72.



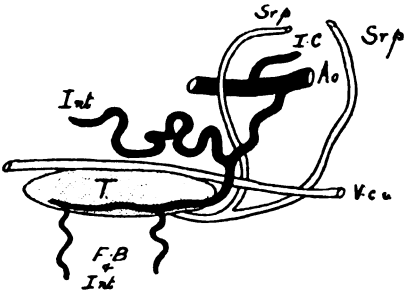
Right testis of *Ophiophagus* and its blood-supply.

Ao., aorta; *F.B.*, fat-body artery; *I.C.*, intercostal artery; *Int.*, intestinal artery; *K.*, kidney; *Sp.A.*, spermatic artery; *Sr.p.*, suprarenal portal vein; *T.*, testis; *V.c.i.*, vena cava.

posterior end, where it is nearly in contact with the kidney. At this point the spermatic artery gives off a branch to the kidney. The spermatic artery runs along the kidney anteriorly on the opposite side to the vena cava, giving off branches to its substance (see text-fig. 72). It also gives off two branches, which supply adjacent viscera: firstly, a stouter branch to the fat-body; secondly, a more slender branch which supplies both fat-body and intestine. Close to the spermatic artery runs a portal vessel to the suprarenal. It emerges from the parietal on the right of the middle line by three roots. The posterior testis, which is considerably the smaller, has also one spermatic artery. This gives a branch to the intestine before it reaches the testis, and later two branches

to the fat-body. The accompanying adrenal portal is formed by the union of two trunks which spring from the left of the middle line.

Text-fig. 73.



Left testis of *Ophiophagus* and blood-supply.

Letters as in text-fig. 72.

Renal Arteries.—The anterior kidney receives altogether seven branches from the aorta, of which, however, the first two arise in common with other arteries and are therefore practically branches of them. I have already referred to them as branches of the spermatic artery and of the inferior mesenteric. The third artery gives off, at about the middle of the diameter of the kidney, a branch to the fat-body; it also emits a very slender branch to the intestine. The third artery has also a fine intestinal branch. Whether the four remaining arteries have or have not such a branch, I am unable to say.

The posterior kidney has fewer arteries. There are only four of them, of which the last bifurcates a little after its origin from the aorta and arrives at the kidney as two arteries. The first renal artery arises between the posterior spermatic artery and the fourth renal artery of the left kidney. The last renal artery arises just behind the first of the intestinal arteries. The ureter of the anterior kidney, at any rate, derives some blood-supply from branches of the intestinal arteries.

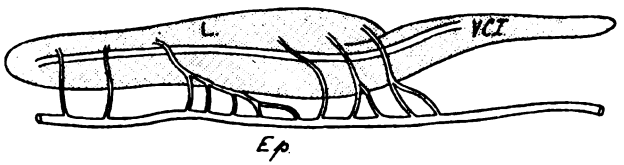
Epigastric Artery.—This artery runs along the median ventral line of the body-wall, in close association with the anterior abdominal vein. The close relationship of the two is shown by the fact that they are both encircled by the same periangious lymphatic vessel. Their branches, moreover, often coincide, and they too are apt to be ensheathed in a common lymphatic trunk. The epigastric artery is continuous from one end of the body to the other, and receives its blood-supplies, as it appears, from any arteries that happen to be adjacent. Thus in the neck the carotid artery sends branches thereto, while in the region of the fat-body the longitudinal artery of that organ sends twigs to the epigastric.

Parietal Portal Veins.—The veins which arise from the dorsal region of the body-wall to be connected with the portal system are, as usual, comparatively few in number. The first vessel springs from the left side of the dorsal middle line, not far from the beginning of the liver. Five intercostals intervene before the origin of the second vein, which has three roots and passes dorsally of the aorta instead of ventrally, as is the case with the first vein. There are only two more veins before the end of the liver. The first of these springs, like the last, from the right side of the median line and passes dorsally of the aorta; it has two roots. So has the fourth vein, which is left-hand in origin and passes ventrally of the aorta. Behind the liver are five more veins, which are all right-hand and pass dorsally of the aorta. The last of the series corresponds to the superior mesenteric artery; it is right-hand in origin, passes dorsally of the aorta, and arises from at least six roots.

The next portal vein belongs to the anterior suprarenal body.

Abdominal Portal Veins.—It is by no means always the case that it is possible to observe these veins with clearness. They are, however, plain in the present specimen, and I counted nine veins entering the liver ventrally, of which many were accompanied by an affluent of the epigastric artery. The first two of these veins enter the liver-substance separately. The next five or six combine to form a short longitudinally-running trunk, and which, so far as I can ascertain, enters the liver at two separate points. Then

Text-fig. 74.



Epigastric vein of *Ophiophagus*.

Ep., epigastric vein with branches to liver; *L.*, liver; *V.C.I.*, vena cava.

follow three vessels situated at approximately equidistant intervals, each of which is formed by the union of either two or three trunks. All of these vessels enter the left liver-lobe, which ends shortly behind the last of them, being much shorter than the right liver-lobe, which is quite one-third longer. The partial union of these before entering the liver seems to me to be a Lizard-like character.

Naia tripudians.

The *anterior vertebral artery* in this Snake has a long course in the neck before it enters the parietes. It only becomes lost to view about half an inch behind the head. The intercostal branches of this artery form an absolutely continuous series

corresponding exactly to the number of vertebræ, and show but the faintest traces of commencing disappearance. That is to say, the arteries are of fair size and equisized; in only one case did I observe an artery reduced to thread-like dimensions. Furthermore, the arteries are accurately median at the points where they enter the parietes, and the foramina through which they enter are larger than the arteries themselves.

Intercostal Arteries.—These arteries commence to arise from the right aortic arch before its union with the left. But in this region they do not form a continuous series; there were only three. After the junction of the two aortæ the intercostal arteries still retain the median point of entrance into the parietes, a position which distinguishes them at once from the intercostal veins—as also in *Lachesis gramineus*. The arteries are very numerous, and there are occasional stretches of ten or a dozen which are continuously at regular intervals. In a very few cases the arteries are so excessively slender as to suggest commencing disappearance. I counted altogether 94 of these arteries, to which I think 3 or possibly 4 are to be added. The total is only just under the 100. As may be inferred from their median position, none of these arteries are paired; nor can an anterior series be distinguished from a posterior, save that the first few are rather farther apart than they become later.

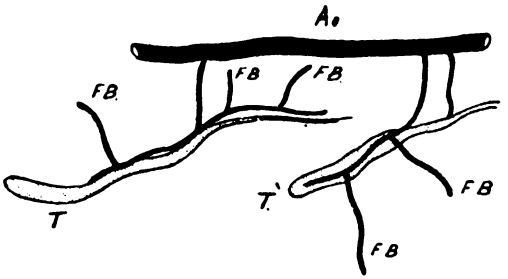
Intercostal Portal Veins.—These veins are, as is usual, few in number when compared with the intercostal arteries. I counted altogether 13 of them, of which the anterior 6 are less important than those which follow. The first 6 lie opposite to the liver, and are therefore not direct affluents of the main trunk of the portal vein. The first arises after the 7th intercostal artery *; the next 5 are separated by fewer intercostal arterial trunks. These first 6 veins spring from the body-wall to the left of the median dorsal line. The 5 following intercostal portals spring from the right side of the dorsal middle line. The first of this series, *i. e.* the 7th of the entire series, is a little beyond the end of the liver. The next two, close together, accompany the posterior gastric artery; the 10th in a similar way accompanies the superior mesenteric, while the 11th and 12th correspond respectively to the testicular arteries. The latter vein and the 13th, which is in the kidney-region, emerge from the body-wall on the left side of the dorsal median line. It will be noticed that some of these veins spring from the middle line of the parietes.

The *spermatic artery* which supplies the anterior testis is a single vessel which enters the gonad near to its posterior end. It there becomes longitudinal and runs forwards as well as backwards along the vas deferens. It is the first artery for the supply of the viscera which is given off by the aorta after the superior mesenteric. This longitudinal testicular trunk gives off one branch anteriorly and two branches posteriorly to its origin from the

* Counting from the junction of the right and left aortæ.

aorta, all of which supply the fat-body. The spermatic artery of the posterior testes is actually the next artery to arise from the aorta; it is immediately followed by a second artery. That the posterior testis has two arteries, while the anterior has only one, is remarkable since the posterior gonad is the smaller of the two. The first artery enters the gonad at the posterior end, which is also the case with the anterior spermatic artery; it runs forward and gives off two branches to the fat-bodies. The second spermatic artery really supplies the vas deferens, and a little farther back along the aorta a third vessel rises. All the arteries of the gonads and their ducts are thus close together.

Text-fig. 75.



Testis and blood-supply of *Naia tripudians*.

Ao., aorta; *F.B.*, arteries to fat-bodies; *T.*, anterior, *T.'*, posterior testis.

Gastric and Intestinal Arteries.—The *gastric arteries* are, as in some other snakes, divided into two series of larger vessels and minute vessels, between which there are none of intermediate size. The minute vessels end upon the surface of the stomach, but I am disposed to regard them rather as supplying the peritoneum. There are three large gastric arteries, apart from the gastric branch of the superior mesenteric. The first one is much smaller than the two which follow; these latter are about equi-sized. The first two are closer together than is the second to the third; the second and the third are about as far apart as is the third from the superior mesenteric. They form, as is usual, two longitudinal trunks running one on each side of the stomach. The second and third are connected with both longitudinal trunks, but the first appears to be connected only with that of the left side.

The *superior mesenteric artery* arises at the commencement of the coiled part of the intestine and some way behind the gall-bladder. Behind this artery there are three which supply the alimentary canal. They lie among the renal arteries, of which two lie in front of the inferior mesenteric.

The *renal arteries* are more numerous in the case of the posterior than of the anterior kidney, thus exactly repeating the

conditions observable in the spermatic arteries. The anterior kidney has but two arteries, of which the first arises in front of the first renal artery of the posterior kidney. The second artery of the anterior kidney arises exactly opposite to the fourth renal artery of the opposite kidney. The posterior kidney has six arteries, which, with the exception of the first, lie between the inferior mesenteric and the ensuing intestinal artery. There is finally an artery to each ureter, of which that to the posterior kidney lies after the fourth intestinal artery.

Python spilotes.

In this Snake the *anterior vertebral artery* is of much less calibre than the right aortic arch, of which it is obviously a branch, and not, as in *Zamenis flagelliformis* (see p. 338), practically its main continuation. It runs up very close to the head before becoming imbedded in the body-walls. It disappears from view only 3 inches behind the tip of the snout. Its branches are regularly intervertebral, and therefore numerous; the most striking difference which the artery in this snake shows from that of *Zamenis* and many other snakes, is the fact of the existence of a branch which may be termed the *posterior vertebral* artery. This is the first branch of the vertebral artery, and is given off immediately after the origin of the latter from the aortic trunk at a distance of 1 cm. from the aortic arch; it has therefore very nearly a separate origin from the aorta. This trunk passes back along the middle line of the body, closely apposed to the parietes; it receives on the one hand the intercostal arteries which arise from the aorta and gives off, on the other, a series of branches which run to right and left and which are, I take it, the equivalents to the branches of the intercostals in many other snakes* which run also right and left. The existence of this superficial posterior vertebral artery is a further extension of the longitudinal system of trunks which is so characteristic of the Ophidia†. This longitudinal artery is not, however, limited to the "thoracic" region; with interruptions it continues considerably farther. The superficial artery ends at a point just about opposite to the commencement of the liver, during which space (of 7 or 8 inches) only two arteries from the aorta reach it. After this point and from it to the end of the liver I counted seven intercostal arteries arising from the aorta. Each of these on arriving near to the dorsal middle line of the body divides and runs forwards and backwards as a superficial vertebral artery, giving off paired branches as usual which penetrate the parietes; the successive superficial arteries are so arranged with reference to each other that they leave no vertebra unsupplied—that is to say, one commences immediately after the end of another. A variable number

* Hopkinson & Pennant (*loc. cit.*) do not figure intercostals at all, and Jacquart does not represent the secondary connections as occurring in the species examined by him.

† *E.g.* Hannah and op. p. 338.

of vertebræ is supplied by each intercostal and its superficial continuations; thus I counted from the beginning of the series 7, 7, 5, 3, 6, 3, 3 vertebræ belonging to the area of each intercostal. In one or two cases it is noteworthy that the superficially running portion of an intercostal did not fork either anteriorly or, it may be, posteriorly to supply both sides of a vertebra; in such cases one side was supplied by the end of one intercostal and the other side by the anterior end of the next intercostal. Immediately after the liver is a stretch of nine vertebræ served by branches of a continuous superficial vertebral which has two intercostal affluents. The rest of the body is supplied by more numerous intercostals, which generally serve only two successive vertebræ and often only one vertebra.

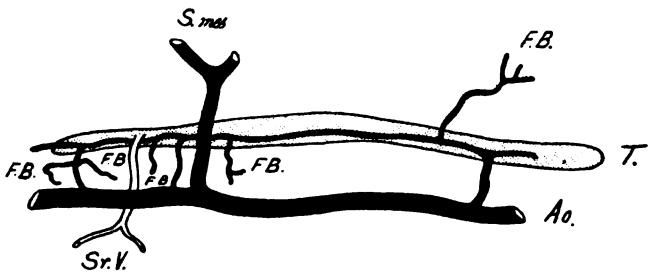
Visceral branches of the Common Aorta.—In the region of the liver a regular series of trunks is given off which supply that organ and the œsophagus. They are closely associated with branches of the portal vein which bring blood from the œsophagus to the liver, so closely that it will be convenient to consider the vessels together. Although the association between the portal vessels and the branches of the aorta is close, there is not an exact correspondence. The first hepatic branch of the aorta is situated about 2 inches behind the anterior end of the liver. It runs straight to the liver, and just before reaching it divides into an anteriorly and posteriorly running branch. The former reaches nearly to the tip of the liver, and takes the place of the two missing hepatic branches of the aorta. About halfway between its origin and its bifurcation a branch is given off to the œsophagus, from which arises immediately a slender twig to the walls of the lung. The portal branch which accompanies it accompanies it closely; its main trunk is derived from the œsophagus, and this lies in contact with the œsophageal branch of the aorta. There is also a branch from the lung-walls also lying close to the lung-branch of the aorta, while the main hepatic stem is accompanied by a portal branch which appears to arise partly from the lung-walls and partly from the walls of the aorta. In front of this first hepatic trunk are two portal vessels arranged at regular intervals, which appear to be serially continuous with the portal branch already described. They are not, however, collecting trunks from the œsophagus, and will be described elsewhere. The next hepatic branch of the aorta arises about an inch further on; it is accompanied by a portal branch which, like the two last-mentioned, mainly collects blood from the body-walls. This second hepatic artery divides into two much earlier than does the first of this series of vessels. There are altogether 8 of the hepato-œsophageal branches of the aorta which arise at rather irregular intervals and have no relation in position or number to the underlying intercostal arteries. Between the first two hepatic branches there is an unusually wide interval, almost suggesting a missing artery. So far as concerns its œsophageal branch this artery is represented by a long descending

branch from the posteriorly running branch of the first hepatic artery. This descending branch also exists in some of the other interspaces, particularly in that between the VIth and VIIth hepato-œsophageal trunks. All the hepato-œsophageal trunks resemble each other in plan, though differing in detail. They all divide near to the liver into a Y-shaped fork, of which one branch runs forward and unites with the posterior branch of the Y in front. The point at which division occurs varies, but it is generally near to the liver. It is much farther away from the liver in the second branch only, as has been mentioned. Each of these trunks gives off at most three branches, which supply the œsophagus and the walls of the lung. More generally there are only two of these branches, and in the case of the 6th vessel I could find only one. The point at which they are given off varies.

Following the eighth vessel, which concludes the series that lie between the œsophagus and the liver, is a ninth branch of the aorta which supplies the same regions. It lies, however, 10 cm. behind the liver and 35 mm. behind the eighth hepato-œsophageal vessel. Between it and the latter are two vertically running branches of itself and the eighth trunk precisely like that which lies between vessels 6 and 7. This ninth vessel is at once the last which supplies the liver and the first which supplies the fat-body.

The gastric region of the alimentary tract is supplied by three arteries, of which the third and last is very much the most important. All of these arteries give off a branch or branches to the fat-body. Both of the first two smaller gastric arteries come

Text-fig. 76.



Anterior testis and blood-supply of *Python spilotes*.

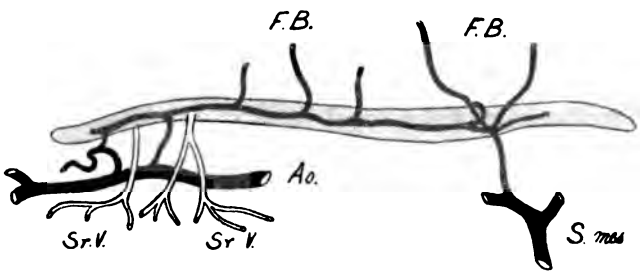
Ao., aorta; *F.B.*, arteries to fat-body; *Sr.V.*, suprarenal portal vein; *T.*, testis; *S.mes.*, superior mesenteric artery.

into direct relations with the third and largest artery. The latter gives off two branches which run forward along the stomach; each of these ultimately ends in the main twig of gastric arteries 1 and 2. The third gastric artery before it divides into these two

gastric branches gives off two small branches to a couple of small glands which lie at the anterior end of the anteriorly situated testis. These glands resemble in a curious way the posteriorly lying spleen and pancreas, and show the same differences in colour. Contrary to what is usually found in snakes, and correlated perhaps with the forward position of the testes, the *first spermatic artery* arises between the last gastric and the superior mesenteric. Arrived at the testis, which it reaches at about the end of the first quarter, the artery divides into an anterior and a posterior longitudinally running branch. The latter gives off shortly a slender and ventrally running branch to the peritoneal sheets envolving the portal vein &c. Further back, and just in front of the superior mesenteric, a dorsally running twig supplies what is, I presume, the mesorchium. Immediately after the superior mesenteric arises the *second spermatic artery* of this testis. The *third spermatic* arises a little farther on, close to the end of the testis, and between them arises, from the longitudinal testicular artery, a branch to the mesorchium. The third spermatic artery gives off before reaching the testis a branch on either side to the mesorchium. Between the two posterior spermatic arteries the adrenal portal vein lies, passing to the adrenal body from the parietes on the right side of the aorta.

The left (posterior) testis has only two spermatic arteries, which lie, relatively speaking, in the same position as the second and third spermatic arteries of the right testis. The last of these gives off before reaching the testes a branch to the mesorchium, which is the only branch of the kind that I could find.

Text-fig. 77.



Posterior testis and blood-supply of *Python spilotes*.

Lettering as in text-fig. 76.

On the other hand, the longitudinal testicular artery gives off at least four slender branches, ventral in direction, which supply the fat-body. The most anterior of these joins a twig of the superior mesenteric which also supplies the fat-body. The superior mesenteric thus also contributes to the blood-supply of the testes.

The *adrenal portal* vessels are more numerous than those of the right adrenal body. The anterior, made by the union of two main branches, each of which recovers blood from three intercostal spaces, enters the adrenal body in front of the anterior spermatic artery; the second, gathering blood from three intercostal intervals, lies between the two spermatic arteries.

Renal Arteries.—In noting the most important fact about the renal arteries, namely, that there is only one to each kidney, it must be borne in mind that the kidneys are extraordinarily small. They measure about $2\frac{1}{4}$ inches in length, and the posterior is situated a foot away from the vent. Each renal artery enters the kidney at its anterior end, and between the two renal arteries arises the inferior mesenteric, which is much more important than any of the slender intestinal arteries which follow.

LACHESIS GRAMINEUS.

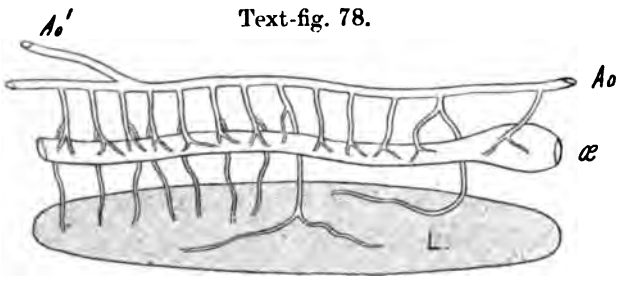
The *anterior vertebral* is short in this species, only reaching to a point $1\frac{1}{2}$ inches from the heart (and 6 inches from the snout) before plunging into the parietes. It gives off but a single intercostal branch, which is not far from its origin. The right aortic arch itself is much more slender than the left; it gives off two intercostal arteries before joining the left aorta. The disproportion between the right and left aorta is so very marked that the former when it joins the latter is not larger than one of the intercostals. After the junction of the aortæ to the posterior end of the trunk there are only 22 intercostals; as is the rule, they become more numerous posteriorly. For example, the region lying between the junction of the aortæ and the origin of the superior mesenteric only gives off six of these arteries. Another peculiarity of this species is the fact that all the intercostal arteries, without a single exception, enter the parietes in the middle line. This is associated with, though it can hardly be caused by, two particularly projecting bands of muscle which lie one on either side of the dorsal median line. That the strong development of these muscular bands has no special relation to the accurately median entrance of the intercostal arteries appears to be shown by the relation to the same of the intercostal portal veins.

Intercostal Veins.—There are six of these veins in front of the point of origin of the superior mesenteric artery; but they have no special correspondence to the six intercostal arteries which arise in the same area. All of these veins emerge from the parietes to the left of the longitudinal bands of muscle referred to. Just at the level of the superior mesenteric artery a stout portal vein emerges from the right side; thereafter follow two veins, also emerging from the right side. The remainder of these vessels (six in number) arise again on the left side of the dorsal median line.

The liver commences very high up in the body. Its apex is

practically in contact with the pericardium. At the opposite extremity it ends but a very short way in front of the gall-bladder. The blood-supply of the œsophagus, stomach, and liver is therefore rather different to that of some other snakes. There are, as is usual, series of *hepato-œsophageal*, *hepato-gastric*, and *gastric* vessels. No arteries, however, supply the liver only to the exclusion of other organs. Altogether the liver is supplied by nine vessels, of which the last two are the largest and run longitudinally and superficially for some distance. The last of these arteries is very nearly converted into an independent trunk, for the gastric branch is given off immediately after the origin of the combined trunk. Between this hepatic vessel and the next one

Text-fig. 78.



Œsophageal and hepatic arteries of *Lachesis gramineus*.

Ao., aorta; *Ao.'*, left aortic arch; *L.*, liver; *œ.*, œsophagus.

in front three arteries arise from the aorta, which only supply the alimentary canal and send no branch to the liver. In front of this again are seven branches of the aorta which supply both liver and gut. The two anterior of these at any rate arise from the left aorta before its union with the right. Apart from these trunks already mentioned, which lie between the last two hepatic arteries, there is only a single gastric artery, which arises from the aorta some little way behind the last gastro-hepatic.

The *superior mesenteric artery* presents no remarkable features. The arteries of the posterior part of the intestine arise in irregular alternation with the arteries to the oviducts, ovaries, and kidneys. A more exact description of some of these arteries is as follows:— The first artery after the superior mesenteric is that to the anterior (and in my specimen not fully developed) ovary. After this arises the posterior mesenteric and, after a gap, two other intestinal arteries; between the last of these and the third intestinal artery are two slender oviducal arteries. Then follows the artery of the posterior ovary (which was full of mature ova). Immediately after this are five oviducal arteries supplying its oviduct, and on the opposite side an oviducal artery belonging to the other oviduct, the first renal artery and the first of a rectal series.

Some General Conclusions.

The facts detailed in the foregoing pages permit of some general conclusions as to the structure of the arterial system in the Ophidia.

In this general survey of that system I have naturally compared my results with the most complete recent comprehensive survey of the vascular system in those Reptiles—that which is given in Bronn's 'Thier-Reich.' I am unable from my own observations to substantiate all that is said in that work, though in many points I can add nothing to the general statements therein contained.

In the first place, though this conclusion can hardly be considered a novelty, it is important to note the prevalence of longitudinal systems which are developed in nearly all the organs of the body. The various regions of the alimentary tract possess longitudinally running vessels which are filled by several branches of the aorta. The same is true of the liver, the fat-body, the gonads, &c. This state of affairs has not been sufficiently fully emphasised in such figures of the arterial system as have been published.

The anterior vertebral artery enters the thickness of the parietes at a variable distance from the head, varying—that is to say—according to the species, and the number of intercostal branches which it gives off upon its course is not, as might be inferred from the general account given in Bronn, three or four only. These numbers do indeed occur; but they are often considerably increased. Moreover, these arteries are, as has correctly been stated, always single—never paired; and it may be added that they always perforate the body-wall exactly in the middle line, which is sometimes, but not always, the case with the intercostal branches of the common aorta. With regard to the latter, it will have been noted that they present many variations. In the first place, they are more or less numerous, and there is no exact correspondence between their numbers and the length of the snake. They may be single or arranged in pairs; both arrangements occur in the same snake. When single they may enter the parietes exactly in the middle line, as is the case with the intercostal branches of the anterior vertebral artery; or they may lie to one side or to the other, in which case there is an alternation in position which is now regular now irregular.

The gastric arteries vary rather more widely than might be inferred from the summary given in Bronn's 'Thier-Reich.' There are as few as one in *Lachesis gramineus*, three in *Naia tripudians*, and as many as ten or eleven in the genus *Coluber*. Their alternate arrangement to the right and left sides of the stomach is a noteworthy point.

The hepatic arteries are sometimes more than ten to twelve in

number. There are, for instance, twenty in *Coluber melanoleucus*, which has not, I may remark, a specially long liver.

The *arteria epiploica*, the longitudinal artery of the fat-body, is fed from several distinct sources. Arteries arise independently from the aorta, from the spermatic arteries, from the oviducal (*arteriæ uterinæ* in Bronn's 'Thier-Reich'), from the superior and inferior mesenteric, from the renal and gastric arteries. But I have not found all these origins to coexist in the same species.

It is clear, from the facts at present known, that the rule among the Ophidia is that each gonad has but a single spermatic artery. The extraordinary length of the testes in *Python spilotes* may account for their richer blood-supply. It is noteworthy, moreover, that the artery or arteries generally reach the testes at their posterior extremity.

On the other hand, the ducts of the gonads, whether male or female, commonly receive their blood-supply from a number of separate branches of the aorta. Exceptionally (as in *Tropidonotus fasciatus*) both ovary and oviduct may be supplied by branches of the superior mesenteric, in addition to their own proper arteries. And this is the case with the testes in *Python spilotes*.

The *renal arteries* appear to vary from a single one to each kidney (*Python spilotes*) to eight such arteries in *Coronella catenifer*. The close association of the arterial supply of gonad and kidney in *Ophiophagus bungarus* (see p. 357) is quite exceptional.

Little attention seems to have been paid to the *epigastric artery*, which, however, exists and has been chiefly studied by me in *Ophiophagus*. It is a continuous trunk running from end to end of the body in close association with the anterior abdominal vein, and is fed by the carotid anteriorly and the fat-body artery posteriorly. As to the venous system, I may chiefly remark upon the epigastric vein, which I have most particularly studied in *Ophiophagus*. It extends along the lower body-wall and sends branches to the shorter lobe of the liver along its whole length.

The portal system of the dorsal parietes appears to exist in all Snakes. The trunks which arise from the parietes appear never to issue from the muscular walls exactly in the middle line; they are always to the right or left of that line, and in this they differ from the intercostal arteries. There is always, or nearly always, a specially large trunk in the immediate neighbourhood of the superior mesenteric artery. It is remarkable that the intercostal veins of the trunk should be connected with the portal systems, while those of the "thorax" and neck open into vertebral veins.

I am able to confirm and extend Gratiolet's discovery* of a suprarenal portal system, which appears to be universally present. I have given above a number of detailed figures showing the number and position of these veins (pp. 358, 364, &c.) in several Snakes.

* "Note sur le système veineux des Reptiles," Journ. de l'Inst. xxi. 1853, p. 60.

From a classificatory point of view the main result which I have arrived at is the recording of certain facts which support the general contention that the Boidæ occupy a basal position among the Ophidia. This view has of course been partly based upon the persistence of rudiments of the hind limbs and of the paired subequal lungs. The fact that the two aortic arches are equisized is another fact pointing in the same direction, as is also the regular series (one to each interorbital region) of intercostal arteries*. The dorsal body-wall, moreover, where these arteries enter is more muscular and less tendinous in structure than in many Snakes. It may, I think, fairly be held that the replacement of muscle by tendon is secondary. In possessing a fairly long azygous vein joining the vertebral vein on a level with the anterior margin of the heart, *Python spilotes* differs from such a form as *Coronella getula*, where the azygos is much reduced. The latter condition seems to me to be in all probability the derived one. The small number of arteries to the stomach, though met with in other Snakes, is at any rate not at variance with the views here advanced; and I am of opinion that the single renal artery on either side—the absence, in fact, of reduplication so common in the Ophidia—is decidedly a primitive character. Gadow, however, found two such arteries in the Madagascar Boa, *Pelophilus madagascariensis*†.

I am unwilling at present to attempt any diagnosis of other genera, though there are plain indications of the possibility of utilising the arterial system for systematic purposes.

* The further connection between these by superficial trunks is possibly to be regarded as a secondary modification.

† See Bronn's 'Thier-Reich,' *loc. cit.* pl. cxxxv. fig. 1.

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The 'Proceedings' for the year are issued in *four* parts, forming two volumes, as follows:—

VOL. I.

Part I. containing papers read in January and February, in June.
II. „ „ „ March and April, in August.

VOL. II.

Part I. containing papers read in May and June, in October.
II. „ „ „ November and December, in April.

'Proceedings,' 1903, Vol. II. Part II. was published on April 1st, 1904.

The Abstracts of the papers read at the Scientific Meetings in January and February are contained in this Part.

PROCEEDINGS

OF THE

GENERAL MEETINGS FOR SCIENTIFIC BUSINESS

OF THE

ZOOLOGICAL SOCIETY

OF LONDON.

1904, vol. I.

PART II.

CONTAINING PAPERS READ IN

MARCH AND APRIL.

AUGUST 1904.

PRINTED FOR THE SOCIETY,
SOLD AT THEIR HOUSE IN HANOVER SQUARE.

LONDON:
MESSRS. LONGMANS, GREEN, AND CO.,
PATERNOSTER-ROW.

[*Price Twelve Shillings.*]

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THIS Society was founded in 1826 by Sir STAMFORD RAFFLES, Mr. J. SABINE, Mr. N. A. VIGORS, and other eminent Naturalists, for the advancement of Zoology and Animal Physiology, and for the introduction of new and curious subjects of the Animal Kingdom, and was incorporated by Royal Charter in 1829.

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The Library (3 Hanover Square), under the superintendence of Mr. F H. WATERHOUSE, Librarian, is open from 10 A.M. to 5 P.M., on Saturdays to 2 P.M. It is closed in the month of September.

The Meetings of the Society for General Business are held at the Office on the Thursday following the third Wednesday in every month of the year, except in September and October, at Four P.M.

The Meetings for Scientific Business are held at the Office twice a month on Tuesdays, except in July, August, September, and October, at half-past Eight o'clock P.M.

The Anniversary Meeting is held on the 29th April, at Four P.M.

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Ladies or Gentlemen wishing to become Fellows of the Society are requested to communicate with the undersigned.

P. CHALMERS MITCHELL, M.A., D.Sc.,
Secretary.

3 Hanover Square, London, W.,
August, 1904.

MEETINGS

OF THE

ZOOLOGICAL SOCIETY OF LONDON

FOR

SCIENTIFIC BUSINESS.

(AT 3 HANOVER SQUARE, W.)

Session 1904–1905.

1904.

TUESDAY, NOVEMBER 15 and 29	TUESDAY, DECEMBER 13

1905.

TUESDAY, JANUARY 17	TUESDAY, APRIL .. 18
„ FEBRUARY 7 and 21	„ MAY .... 2 and 16
„ MARCH .. 7 „ 21	„ JUNE 6

The Chair will be taken at half-past Eight o'clock in the Evening precisely.

March 1, 1904.

Dr. A. GÜNTHER, F.R.S., Vice-President, in the Chair.

The following motion, of which notice had been given at the Meeting held on February 16th, was put to the Meeting by Mr. R. I. Pocock, seconded by Mr. R. H. Burne, and declared to be lost by a very large majority :—

> "That it is desirable to alter the hour of the Meetings for Scientific Business from 8.30 P.M. to 5 P.M."

Dr. A. Günther, F.R.S., exhibited and made remarks upon some specimens of hybrids between Reeves' Pheasant (*Phasianus reevesi*) ♂ and the Silver Pheasant (*Gennæus nycthemerus*) ♀.

Mr. Oldfield Thomas exhibited the skull of a Buffalo which, with several others, had been obtained in Ankole, S.W. Uganda, during Col. Delmé-Radcliffe's delimitation of the Anglo-German Boundary.

The horns of this buffalo were remarkably broad and flat in the palm, and their bases diverged considerably from each other in front, contrasting in these respects with those of the true *Bubalus caffer* of South Africa, which were very convex on the palm, while their inner edges (close to each other in old bulls) were quite parallel.

The animal was of considerable size, the skull of the type-specimen measuring 505 mm. in basal length, while its horns were 1106 mm. (= 43½ in.) between the most distal points of their outer convexity, and 295 mm. (= 11½ in.) across the palm in a straight line, measured with callipers.

An old female skull was 455 mm. in basal length, with a greatest horn-spread of 842 mm., the palms being 141 mm. broad.

All the specimens sent were closely similar, and Mr. Thomas thought that a subspecific name should be given to the animal, which represented a northern race of *B. caffer*, fully as large as the latter, but tending in the flatness of its horns towards the smaller *Bubalus æquinoctialis* Blyth, of the Upper Nile.

Mr. Thomas therefore suggested for it the name of *Bubalus caffer radcliffei* (cf. Abstr. P. Z. S. 1904, No. 4, p. 13, March 8) in honour of its donor.

Mr. Oldfield Thomas also exhibited a Fruit-Bat which had been obtained by the expedition to Fernando Po subsidised by the Duke of Bedford and Mrs. Percy Sladen.

This Bat belonged to the rare genus *Scotonycteris*, but did not

appear to be referable to *S. zenkeri* *, the only known species; and was therefore described as new, as follows:—

SCOTONYCTERIS BEDFORDI †.

Scotonycteris bedfordi, Thomas, Abstr. P. Z. S. 1904, No. 4, p. 14, March 8.

Near *S. zenkeri*, but ears much smaller.

Size rather less than in *S. zenkeri*. Fur close, fine and woolly, the hairs of the back about 6 mm. in length. Fleshy part of forearms, wing-membrane bordering flanks and hind limbs, upper side of legs to ankles, and interfemoral membrane (except terminal part near calcar) well clothed with fur; the centre of the interfemoral quite buried in thick fur. Below, the fur was less extended, only covering the proximal part of the wing-membrane and the centre of the interfemoral.

General colour above mixed whitish and ochraceous buff, the hairs dark brown at base, then silvery white, their tips pale brownish buffy or "clay-colour," the peripheral hairs of membranes and limbs wholly of the latter colour. Head rather browner than back. Central white muzzle-patch present, as in the type species; eyes with dark rims, interrupted behind by small white postocular spots, only about 2 mm. in diameter. Owing to the general light colour, these patches are but little prominent. Ears very small and narrow, conspicuously smaller than in *S. zenkeri*. Throat and centre of chest creamy whitish, passing on shoulders, sides of body, and inguinal region into brown.

Dimensions of the type:—

Forearm 48 mm.

Head and body (original measure in the flesh) 71; ear (in flesh) 11; thumb (c. u.) 23; first finger—metacarpal 34, 1st phalanx 24, 2nd phalanx 30; fifth finger 63; tibia 20; calcar 6.

Hab. Fish Town, Fernando Po.

Type. Female. Original number 31. Collected 2 January, 1904, by E. Seimund.

This interesting Bat, which had been named in honour of its joint donor, the President of the Society, was the first representative of the genus *Scotonycteris* received by the National Museum, and was therefore a most welcome accession. It differed from *S. zenkeri*, of the Cameroons, by its conspicuously smaller ears, which were only 11 mm. in length, while those of *S. zenkeri* were stated by Dr. Matschie to be 17 mm. long, a measurement that quite agreed with their appearance in his plate. *S. bedfordi* also seemed to have smaller postocular spots and a more hairy interfemoral membrane than its mainland ally.

* Matschie, SB. Ges. nat. Fr. Berl. 1894, p. 202; Flederm. Berl. Mus. Megachiroptera, p. 70, pl. 13 (1899).

† [The complete account of the new species described in these communications appears here; but as the names and preliminary diagnoses were published in the 'Abstract,' such species are distinguished here by being underlined.—EDITOR.]

Mr. J. ffolliott Darling, F.Z.S., exhibited some photographs of a very large specimen of the Woolly Monkey (*Lagothrix humboldti*), and made the following remarks :—

"This specimen, seen and photographed in Southern California last year, was a male and weighed about 55 lbs., and, when standing erect, was about 3 feet in height. He was very fat and much the largest example of this species I have ever seen. He was not only remarkable for his immense size, but for his partiality for standing and walking erect and the intelligent manner in which he used his tail to assist him in that position; at times he supported himself by it somewhat after the manner of a Kangaroo, and at others clung to an iron bar by it and so helped to keep an equilibrium.

"I attribute the fact of such a delicate monkey having lived for many years in confinement so far north of his regular habitat, on the upper waters of the Amazon, Rio Negro, and Orinoco rivers, to the extreme equability of the climate on the seaboard of Mexico and to his spending every day in the open air."

Dr. Walter Kidd, F.Z.S., read the following note on the arrangement of the hair on the nasal region of the Parti-coloured Bear (*Æluropus melanoleucus*) :—

"In the memoir of Professor Lankester, published last year in the 'Transactions' of the Linnean Society, on the Affinities of *Æluropus melanoleucus*, no reference is made to the mode of arrangement of the hair on the nasal region. This is of the Derivative type (sketched on blackboard), in which respect *Æluropus* differs from all the Ursidæ as well as from *Procyon*, and in which it resembles the Felidæ. It can hardly be claimed that a character so superficial and intrinsically unimportant as this can contradict the veiw of the affinities of this creature, which are based on the more stable osteological and dental characters. If it be not a character indicating affinity, this arrangement of the nasal hair-stream may be held to have arisen in one of two ways—either by being simply correlated with the broad zygomatic region of *Æluropus*, or as the result of some habit peculiar to it. Whatever the explanation may be, the fact seems to be worth recording."

Mr. R. E. Holding exhibited and made remarks upon the double head of a Dorset Lamb. The heads were of unequal development and united from the orbit to the base of the skulls. In the longer head the palate was cleft along its entire length, the lower jaw having a complete set of deciduous incisors. The smaller head had also the palate completely cleft and a small opening in place of the mouth; there was no trace of either tongue or lower jaw. The upper or dorsal aspect of the

specimen showed absence of the parietal and occipital bones, the brain being absent with the exception of portions of the frontal lobe. The cut end of the neck exhibited a well-formed spinal cord, its anterior end being lost in the membranous lining of the base of the skull; there were only two ears.

Mr. Holding also exhibited the skull of a Spanish Four-horned Ram, showing complete dislocation and partial fracture of the skull from base of nasal bones to occipital, due to a combat with a rival ram.

Mr. J. G. Millais, F.Z.S., exhibited some pelages of the Grey Seal (*Halichœrus gryphus*) taken from the animals in various stages of growth from birth to maturity, and made the following remarks:—

There is no European mammal, exclusive of the Whales, the pelages and life-history of which are so little known as those of the Grey Seal. If we look through the recorded history of the animal we find only endless confusion with another large pinniped, namely the Bearded Seal (*Erignathus barbatus*), to which the Grey Seal certainly bears a somewhat similar appearance in the adult state. After various accounts suggestive of its rank, Fabricius, in 1791, gave the first systematic name to the Grey Seal, and pointed out many of its main characteristics; but even after this date little was known of the animal, and to this day such experienced and practical men as the Dundee and Newfoundland seal captains fail to recognise any difference between the large Ice Seal and the dweller on the rocks. Both species are known to them as the *Square phripper* or *Square flipper*. Even, too, with all the strides that have taken place in modern zoology, we find, on turning to recent literature, but few references to the Grey Seal, little being said of its habits and practically nothing as to its pelage, growth, and the finer points of its life-history.

Dr. Edmonston gave us an admirable little paper on the Seals of the Shetland Islands in 1837, which included many excellent references to the Grey Seal; and Prof. Robert Collett a good account of the breeding-habits of the species, taken from observations in the Fros and the Vigten Islands in Norway, and published in the Zoological Society's 'Proceedings,' 1881; but Mr. Allen, in so comprehensive a work as 'Pinnipeds of North America,' confessed that he was able to describe the species only from two skulls and skins, whilst his general descriptions were taken from the writings of many who knew the animal only slightly or from hearsay. European museums, too, even our own admirable National Collection, seem to suffer from a lack of specimens, and without the examination of a very large series, it is impossible to describe accurately this interesting animal.

It is this difficulty of obtaining skins, and the fact that the animal must be hunted in dangerous and exposed situations, that

has caused our want of knowledge. Some years ago, when I began to study the Seals inhabiting our coasts, I saw how necessary it was to obtain a large series of skins before expressing any opinion; but now, after several expeditions to nearly all the British haunts of this animal, and the examination of over a hundred and fifty skins, I am able to come to some definite conclusions with regard to the pelage and gradual life-growth.

In the first place, there is no mammal, not subject to a very wide distribution, such as *Ursus arctos*, which evinces so many types of pelage and intermediate forms, and this is all the more remarkable because all these various colourings and modulations may be found in a single colony of animals inhabiting one group of rocks. These types are as follows:—

Adult Males.

Four distinct types are found, as well as every intermediate form between them, that is, specimens may occur which are composite of two, three, or even four types.

1. *The Black Male.*—Hair all over body very dark ash-grey and sometimes jet-black. Commencing at the angle of the jaw and extending round sides of neck are certain bands of hair usually darker than the rest of the pelage and often curling*. In this type the under parts are generally slightly lighter, with a brownish tinge, and whole crown of the head light grey. However, I have seen two complete melanic forms which were quite black all over. The black type is somewhat rare, and occurs about one in twenty individuals.

2. *The Light Grey Male.*—This form usually has dun-coloured under parts and flipper-pits. All the upper portions are pale grey, and black "ropes" of curling hair partially encircle the neck and extend as far as the shoulders. Crown of the head silvery grey, and muzzle slightly darker. An uncommon type.

3. *The Blotched Male.*—This is practically a composite form of the two preceding types, but the belly shows generally a white ground with heavy grey and black blotches superimposed. The upper surface is light grey with large dark blotches of blackish grey. Crown of head pale silvery grey and muzzle brownish black. Occasionally this type has dun markings on the belly and flipper-pits. A common type.

4. *The Grey Spotted Male.*—This pronounced type shows a strong line of demarcation between the upper parts, which are a pure grey, and the throat and belly, which are a pure white. Over the whole of the upper and lower portions of the pelage are scattered a number of large black spots. A few small spots are sometimes seen on the sides of the head, the muzzle, and the flippers.

* When in full coat in October the old males frequently grow hair on the neck, which is much longer than the pelage on the rest of the body, and in the case of the light grey males these ridges of hair are often long lines of black, which, as Edmonston has already noted, give the animal the appearance, when rearing his head out of the water, as if several small ropes encircled the throat.

Crown of head pale grey. This is by far the commonest type of adult male, and quite 60 per cent. belong to this form. The "rope"-like markings on the neck are seldom seen in this type. Although I have never yet examined a specimen, I have strong reasons for believing that sometimes silvery grey-white adult males may occur. These are probably not albinos, but simply extremely light-coloured examples of the light type on which there are no spots, and have been seen lying on rocks with the sun playing on them. Mr. Sutherland, the keeper at Kintradwell, Sutherland, who has seen and shot many Grey Seals, stated in a letter to me that he had twice seen a big male that was pure white, and for two seasons a large male has frequented the outer skerries near Belmullet, and been seen several times by Philip Lovell, the "king" of Inniskeara, who has lived amongst these seals all his life.

The pelage in the adult male and female is short and somewhat rigid. In the late summer and autumn it is somewhat sparse, but is close and pretty thick from February to May, when it is in best condition. Mr. Allen, and others who have since quoted from his writings, say that the hair is often recurved at the tips, but this is not my experience except in stuffed specimens subjected to artificial heat.

The skin of the adult male emits a pungent odour resembling coal-tar, and this scent is strongly retained after curing, as is the case with petrels, &c. In the females this odour is scarcely noticeable and is lost after death.

Adult Females.

Adult females are represented by two distinct types. They are much paler in colour than the males, and vary less in their pelages.

1. *The Light Grey Female.*—Quite 95 per cent. of female Grey Seals conform to this pelage. A pure bluish grey is found over all the upper parts, whilst pure white hair covers the belly and throat, a few black spots are generally seen on the shoulders and fore flippers, and the lower throat is well marked with black spots. When in full coat these females possess a beautiful silvery sheen over the whole coat, which, taking on the lights of the surrounding sea and sky, gives the pelage an iridescence of many hues. The crown of the head, although a very pale grey, is especially bright as well as the flanks, and at a distance the Seal looks silvery white*.

2. *The Dark Spotted Female.*—I have never seen a "black" female, although I have reason to believe that such has occurred.

* The variation of the colour in a single specimen of the Grey Seal is most remarkable when the light strikes it in different ways. An adult female, lying on a rock with the sun directly overhead, looked almost silvery white, in a side-light sea-green, and afterwards, in a room without the influence of outdoor effects, a pure grey. The reader must therefore feel some sympathy with the artist who has to reproduce such chameleon-like changes in the coat of a single animal.

The type of dark female had the usual demarcation of grey upper parts and whitish under parts, but the whole is so suffused with ashy grey and black spots and blotches that the whole pelage appears to be blackish grey. The muzzle is dark, and the crown, as usual, pale grey.

If there is one external characteristic which marks out the Grey Seal for superficial identification, it is the pale-grey crown of the head. This feature is present in nearly every example of both male and female of whatever type, and, even when they were swimming in the sea at a distance of half a mile, I have been able with certainty to distinguish this Seal from the Common Seal, the head of which always looks black, bullety, and glistening.

In adults the mystacial bristles are abundant, very stiff, and curiously crenulated, which gives to certain old males a rather "walrusy" look. The snout is unusually elongated, especially in the old male, whilst the muzzle is very broad and fleshy, with the nose aquiline. These characteristics are more subdued in the female, and her eyes have a more benevolent expression. The eyes of the old male are somewhat sunk, and, when angry, he has, like the big carnivora, a most ferocious expression. In the fore feet the two first toes are of equal length and have large nails, whilst the hind feet are deeply emarginated, the outer toes forming long fingers and only possessing small nails. In very old males these nails become almost completely worn away, and the animals do not seem capable of renewing them. The length of adult males varies from 7½ to 10 feet. From the measurements taken by myself of 27 adult males, I find 8 feet to 8 feet 6 inches to be the common length. 9 feet 6 inches is that of the largest animal I have handled; but I have little doubt that monsters of 10 feet and even over are sometimes to be found, and I think that I once shot and lost one as large as this. The statement that males of 12 and 13 feet have been captured must be accepted with reservation, and it must be recollected that the sportsman generally measures his seal from the nose to the end of the hind flippers, and not from the nose to the end of the tail, as he should do. The adult males vary a good deal in weight, as some of them are long, lanky-looking creatures, and others very short for their size and thickset.

A big male shot by Sir Reginald Cathcart on South Uist weighed 50 stone, and in the 'Vertebrate Fauna of Argyll and and the Inner Hebrides,' Harvie-Brown and Buckley state:—"Mr. Henry Evans records the weight of one killed at 48 stones, and he has known them to reach 9 feet in length. We ourselves, we believe, have seen specimens exceeding this size in the Outer Hebrides. One shot by Mr. M'Neill, Jun., of Canna, as he assured us, weighed 45 stones 5 lbs., and was the largest ever seen or recorded there (1881)."

Dr. Edmonston, who had a long experience of these Seals in Shetland, gives the weight as 639 pounds. The largest male he examined was "8 feet from the muzzle to end of tail; girth round

the shoulders 6 feet. The hide weighed 55 lbs., the blubber 145 lbs.; weight of the whole body 6 hundredweight; whilst Prof. Collett states that a full-grown male Grey Seal weighs from 250 to 290 kilogrammes, and contains blubber of the weight of 70 or 90 kilogrammes, a few extremely large ones perhaps reaching 100 kilogrammes. The females weigh from 180 to 250 kilogrammes, as a rule about 220. During the pairing-time the males lose from 50 to 79 kilogrammes. The females, the blubber of which, so to speak, is transferred through the milk to the pups, lose much less, or from 30 to 50 kilogrammes. They do not regain their good condition before the summer." I do not think that this is quite correct, as three adults examined in March and April were extremely fat.

An adult female shot by myself at Langasgeir, North Uist, in August 1890, weighed exactly 21 stone 8 lbs., on some sheep scales the accuracy of which I had previously tested. Length from nose to end of tail 6 feet 1 inch, length from nose to end of hind flipper 7 feet 1 inch; circumference immediately behind the fore flippers 4 feet 7 inches. The usual length of adult females is from 5½ to 6½ feet. Mr. Ball, writing to Professor Bell in 1837, describes how he captured an old female near Howth. The skeleton measured 7 feet 2 inches*, and the estimated weight over 500 pounds. I should imagine this to be the maximum size of females. Another old female which I shot lying on some rocks near the Holm of Gloup, Yell, Shetland, in August 1901, measured 6 feet to end of tail and 6 feet 11 inches to end of flippers. I had no means of weighing the specimen accurately, as I had in the first case, but should say it was about 20 stone.

The young are at first pure white, with sometimes a few grey hairs on the top of the head, the coat being smooth and silky, but in a few days becoming creamy-coloured and woolly. At the end of a week the coat is dull yellow, with more blackish hairs on the head, and blotched with pale grey on the nape. At birth the hair is very white and silky, but soon grows rapidly, and slightly curls as it turns yellow. About six weeks after birth this coat is shed, and gives place to a shorter and closer covering of yellow interspersed with grey and black. Some examples are also green, and some reddish, with a faint dappling of dark markings on the back.

Pure melanisms of this Seal must sometimes occur, but are without doubt of great rarity. One undoubted instance of a baby Grey Seal, black from birth, has come under my notice. Maj.-Gen. Sir John MacNeill and two other men, who are well acquainted with this Seal in its feral state, were rowing past a small island off the west coast of Colonsay when they passed close to 13 Grey Seals' pups about 3 weeks old. One of these was jet-black all over. All the young animals were plainly seen by the occupants

* This measurement was evidently taken from the nose to the end of the hind flipper.

of the boat, who saw that they were of equal size and as yet too small to take to the water*.

When the young Grey Seal is about 28 weeks old its pelage begins to fade rapidly until, by the beginning of April, it is often of a pale uniform straw-colour, with the back-spottings of undetermined brown. At this stage it loses its second coat of hair, and the third pelage commences to appear. This third pelage is more pronounced in colour, and gives indications of the coat that the animal will eventually assume when adult, but the old hair often changes to most extraordinary colours just before shedding. I have seen immature skins of 26 weeks old with hair of russet, dark brown, green, yellow, blue-grey without spots, blue-grey heavily spotted with black, neutral tint, and creamy white. The commonest type, however, of both males and females at this age is pale grey back, turning darker towards the crown, yellow under parts, muzzle and flippers, and with dark grey spots on the back. Such a variety of tints is not to be found in any animal except *Ursus arctos*. On reaching the third pelage most of these strange colour-tints vanish, and we find the young Grey Seal about 4 feet 6 inches in length, and 90 to 100 lbs. in weight, and evincing the dappled, grey, black, or light-grey types of adult males and females respectively, although not yet in perfect completeness.

At one year old the young Grey Seal, when in third pelage, has gained the white under parts with black spots, but has gained little in size after the fourth moult to the fourth pelage; however, when the types become still more pronounced, they progress quickly, so that at two years the length of males is usually about 5 feet 6 inches, and weight from 12 to 14 stone. In each succeeding year additional weight is put on. At three years males measure 6 feet and over, and I do not think they are fully adult until the fifth year, at which age they are capable of entering the breeding-grounds and asserting their sex. Adults allow no immatures except those of one year old to come close to the rocks on which the females pup, and even these youngsters do not land until the breeding-season is over.

The following papers were read:—

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* The reader will at once put the question, "How do you know that the regular black form, for it is a regular type of this Seal, is not always black from birth like this melanic pup?" It is certainly a natural supposition, for without doubt this abnormal juvenile would have become a pure black adult; but, on the other hand, I must put forward the opinion that the black males must almost without exception have been once *white* pups, for I have seen two skins of 5 and 8 months old youngsters actually in a state of change from the light second youthful coat to the black adult. Moreover, such a thing as a black baby *H. gryphus* of a few weeks old has only once been heard of in the big haunts of the Grey Seal, where hundreds of pups were annually slaughtered and where adult males of the black type occur about one in every 20 specimens.

1. On some Nudibranchs from East Africa and Zanzibar. Part IV.* By Sir C. Eliot, K.C.M.G., late H.M. Commissioner for the East African Protectorate, F.Z.S.—Dorididæ Cryptobranchiatæ, II.

[Received January 23, 1904.]

(Plates XXIII. & XXIV.†)

[The complete account of the new species described in this communication appears here; but as the names and preliminary diagnoses were published in the 'Abstract,' such species are distinguished here by being underlined.—Editor.]

In my last paper ‡ I discussed the Cryptobranchiate Dorids represented by such genera as *Archidoris*, *Discodoris*, *Platydoris*, &c. These are oval flattish forms, mostly of sombre coloration, with a dorsal surface rarely smooth but generally granulated, or bearing papillæ, warts, or tubercles. The branchiæ are usually tripinnate. A labial armature is more often absent than present, there is no central tooth, and the radula consists of uniform, simply hamate teeth, rarely differentiated or denticulate. In the present paper I propose to consider some forms belonging to another group typified by *Chromodoris* and its allies. These Dorids are often (but not always) elongated and limaciform in shape, brightly coloured, and smooth. The branchiæ are usually simply pinnate. A labial armature is nearly always present (absent only in *Thorunna* and *Aphelodoris*). In the radula a central tooth is rare, but sometimes occurs (in *Cadlina*, *Tyrinna*, and *Chr. scabriuscula*), and rhachidian thickenings are frequent. The teeth are generally denticulate, and the tooth next to the rhachis is nearly always different in shape from the others. The stomach is usually enclosed in the liver, and there is rarely any armature in the reproductive organs. All these characters are well seen in *Chromodoris*; and I am inclined to think that the following genera are more or less closely allied to it:—*Casella*, *Ceratosoma*, *Thorunna*, *Aphelodoris*, *Orodoris*, *Sphærodoris*, *Cadlina*, *Tyrinna*, *Halla* §, *Rostanga*, and *Audura*. The common character possessed by all these forms is in the mouth-parts:

* For Part III. see P. Z. S. 1903, vol. ii. p. 354.

† For explanation of the Plates see p. 406.

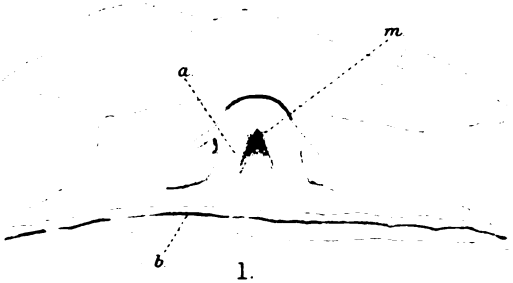
‡ Since writing the third part of this paper (*cf.* P. Z. S. 1903, vol. ii. p. 354) I have read the last fasciculus by Prof. Bergh which has appeared in Semper's 'Reisen' (Bd. ix. Th. vi. Lief. i. Nudibranchiata, January 1904), and it appears to me that the genus *Peronodoris* is practically equivalent to that which I proposed to call *Solerodoris*, and as it has priority should take the place of the latter name. The only difference in the generic characters is that for *Peronodoris* is given "penis stylo armatus." I did not see this style in any of the forms which I have described, but even if it is present in some species and absent in others, this variation would not in my opinion necessitate the creation of separate genera.

Archidoris violacea Bergh seems nearly allied to my *A. africana*, and *A. nanula* Bergh to my *A. minor*; but the identity of the forms, though not impossible, cannot be demonstrated from the descriptions.

§ [This name is preoccupied by a Polychæte worm, *Halla parthenopeia* A. Costa, Ann. Accad. d. Aspiranti Naturalisti Napoli, ii. p. 63 (1844).—C. Crossland.]

2.

3.



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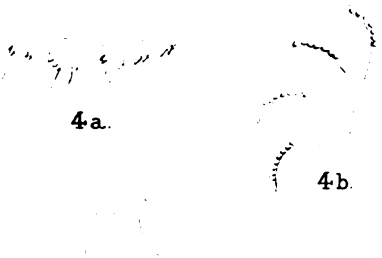
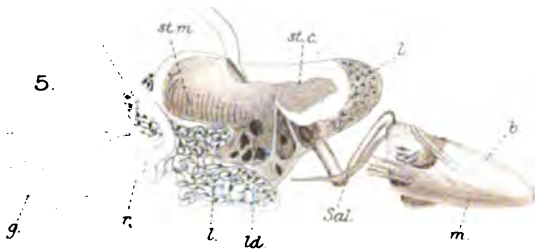


4a.

4b.

4c.



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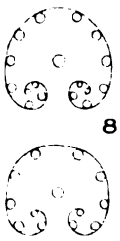


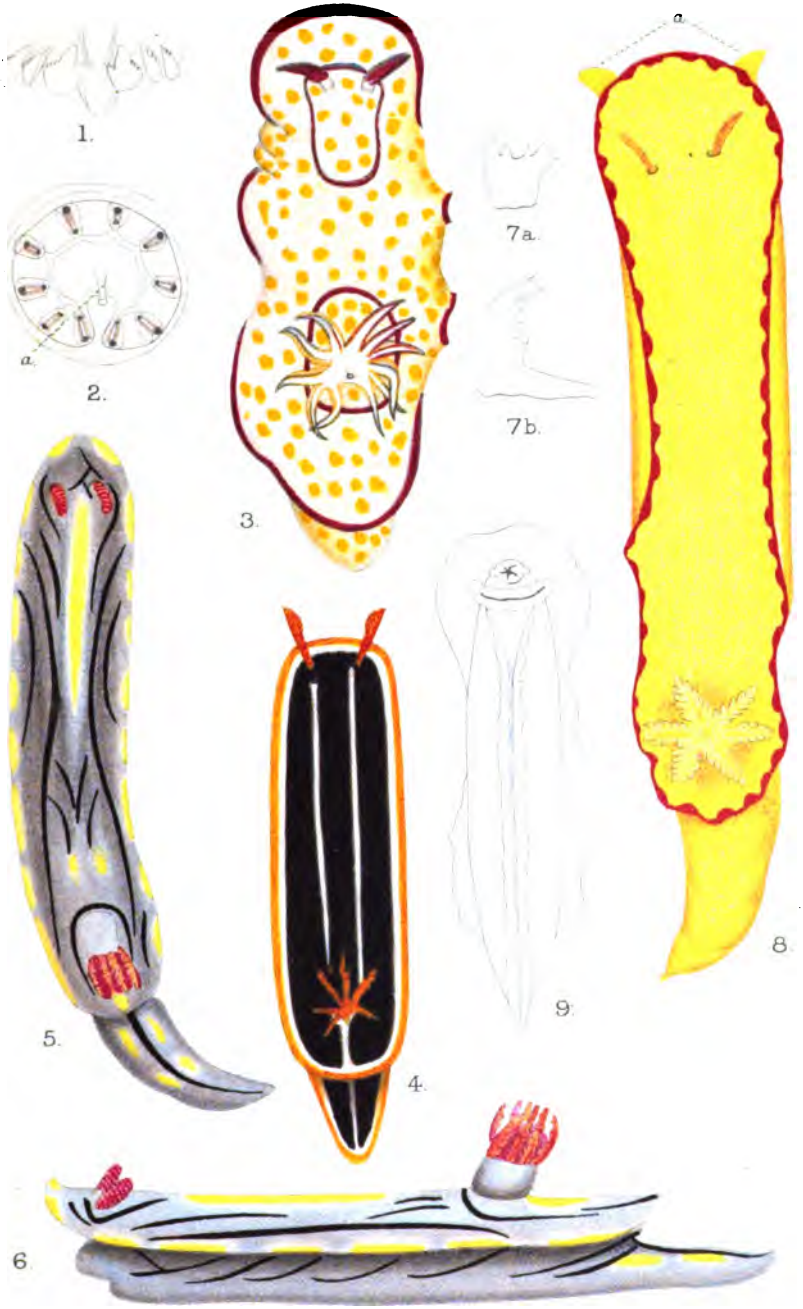
8a.

8b.

6.

C. Crossland del. Huth sc et imp.

1-5. CHROMODORIS RETICULATA. 6. C. SYKESI.
7, 8. C. CAVÆ.



C Crossland, del

Huth, sc. et imp

1-3. CHROMODORIS ANNULATA. 4. C. ELIZABETHINA.
5, 6. C. NIGROSTRIATA. 7. C. LINEATA. 8 & 9, C. FLAVA.

nearly all have a labial armature, and all * have teeth more or less differentiated. I confess that I am afraid of attaching too much importance to the radula: a case like *Aldisa*, where a Dorid with otherwise ordinary characters has a unique dentition, certainly shows that the teeth may vary without any corresponding change in other characters; but in the genera here grouped together it will be found that the buccal characters are usually accompanied by some other feature which allies them to *Chromodoris*, such as simply pinnate branchiæ or a long narrow shape. It may be said that the teeth of Dorids are never really uniform, and in the genera described in my previous paper are often denticulate at the outer end of the row. This is true, but the outermost teeth are less well developed and more exposed than the others. They therefore have a natural tendency for purely mechanical reasons to become smaller and more irregular, and a particular form of this irregularity, due perhaps to some peculiarity of texture, is seen when they split up and become jagged or denticulate. But no such mechanical explanation will account for the innermost teeth being larger and more elaborately formed than the rest. Also this peculiarity is confined to certain genera, whereas the irregularity of the outermost teeth is general among the Cryptobranchiates and as noticeable in *Chromodoris* as elsewhere.

Casella and *Ceratosoma* are clearly closely allied to *Chromodoris*, the former being perhaps not really a separate genus. *Thorunna* is practically *Chromodoris* without a labial armature. *Aphelodoris* has an elongate shape and narrow mantle-edge, but tripinnate branchiæ and no labial armature. It seems, however, to be allied to *Chromodoris* by the presence of an accessory denticle on the innermost teeth. The remaining genera are of more or less oval shape, with a fairly wide mantle-margin, and papillæ or tubercles on the back, peculiarities which are found in some species of *Chromodoris*. *Sphærodoris* has simply pinnate branchiæ and a radula which, though peculiar, is essentially of the *Chromodoris*-type. *Orodoris*, which Bergh associates with *Sphærodoris* and *Miamira*, has the median part of the radula much as in *Chromodoris*. *Halla* † and *Rostanga* are allied to *Chromodoris* by their simply-pinnate branchiæ as well as by their buccal parts: indeed, the former appears to me almost an aberrant Chromodorid akin to such forms as *Chr. sykesi* described below. In *Rostanga* the Mediterranean species *perspicillata* has denticulate inner teeth: in *coccinea* they are merely bifid. The buccal parts of *Tyrinna* and *Cadlina* strongly resemble those of *Chr. scabriuscula*, which has also a somewhat oval form and tuberculate back. I somewhat doubtfully refer *Audura* to the same group, in virtue of its radula. This position is somewhat supported by its smooth skin and scanty bipinnate branchiæ, but the structure of the foot suggests other affinities.

* Except the very anomalous *Miamira*, which Bergh regards as allied to *Sphærodoris* and *Orodoris*.

† See note § on p. 380.

The following is a list of the forms noticed below :—

Chromodoris A. & H.
1. *Chr. reticulata* Pse.
2. *Chr. sykesi.*
3. *Chr. cavœ.*
4. *Chr. annulata.*
5. *Chr. splendens.*
6. *Chr. tryoni* (Gar.).
7. *Chr. vicina.*
8. *Chr. elizabethina* B., var. *africana.*
9. *Chr. runcinata* B.
10. *Chr. nigrostriata.*
11. *Chr. scurra* B.
12. *Chr. hilaris* B.
13. *Chr. lineata* Souleyet.
14. „ „ var. *nigrolineata.*
15. *Chr.* ? *magnifica* Q. & G.
16. *Chr. inconspicua.*
17. *Chr. flava.*

Casella H. & A. Adams.
18. *Cas. atromarginata* (Cuv.).

Ceratosoma Adams & Reeve.
19. *Cer. cornigerum* (Ad.).

Sphærodoris B.
20. *Sph. lævis* B.

Orodoris B.
21. *O. miamirana* B. } (From Willey's New Britain Collection.)
Miamira B.
22. *Mia. nobilis* B.

Genus CHROMODORIS.

More than 100 forms are referred to this large genus, but are by no means all equally certain. About 40 have been described by Prof. Bergh, and may be regarded as well established. Most of the remainder are known only from the external characteristics often very superficially described, and many of the so-called species are probably merely varieties.

The animals are as a rule soft, smooth, and brightly coloured. The branchiæ are simply pinnate, the tentacles small and capable of retraction. There is a strong labial armature and a characteristic radula. The rhachis often bears thickenings: the first tooth on each side of it is denticulate on both the inner and outer sides, and thereby differs from the rest, which are denticulate on the outer side only. The outermost are irregular and denticulate on the apex only. There is no stomach outside the liver.

Within the limits of these characters there is such great variety that it may be doubted if the genus should not be split up.

The following notes on the principal divergencies presented have no pretension to be exhaustive, but may perhaps prove useful.

1. As a rule the shape is somewhat high, elongated, and limaciform, with a narrow mantle-edge, but some species are low and distinctly oval, with the mantle-edge very wide and ample. Such are *Chr. reticulata*, *sykesi*, *cavæ*, and *annulata* here described; and it would appear from the published plates and descriptions that *Chr. albescens*, *iheringi*, *punctilucens*, *histrio*, *propinquata*, *splendens*, *albo-pustulosa* have a similar shape. Some species (e. g. *Chr. vicina*) are capable of assuming two forms—one high and narrow, the other flat and oval; so the distinction in shape may perhaps not be absolute *.

2. The skin is usually soft and smooth, but the dorsal surface bears tubercles in *Chr. orsinii*, *sannio*, *pustulans*, *verrucosa*, *lapinigensis*, and the somewhat doubtful *roseopicta* of Verrill. The very abnormal *Chr. scabriuscula* is spiculate with hard lumps.

3. *Chr. runcinata*, *pantharella*, *sannio*, *picturata*, *camœna*, *elegans*, *glauca*, *californensis*, *gonatophora*, *sycilla*, have small knobs, apparently of a glandular character, on the underside of the mantle-margin.

4. The colour is hardly ever uniform. There is usually a coloured border (sometimes double) round the mantle-edge, and generally a pattern on the back formed of stripes or spots. Although this pattern may vary considerably within the species, the spotted and striped forms appear to be distinct. Sometimes, however (*e. g.* in *Chr. runcinata*), spots arranged in a line unite to form a stripe, and *Chr. semperi* and *nigrostriata* appear to be the same, except that the first is spotted and the second striped. It would be rash in the present state of our knowledge to make any general statement as to the correspondence between these two types of pattern and other characters, but in a considerable number of species stripes are combined with an elongate form and bifid teeth, with or without accessory denticles under the bifurcation (e. g., *Chr. cærulea*, *gracilis*, *messinensis*, *sycilla*, *carnea*, *hilaris*, *lineata*, *marenzelleri*, *thalassopora*, *lapinigensis*); while another combination, of an oval form, spotted pattern, and teeth bearing many denticles but not bifid, is presented by *Chr. reticulata*, *sykesi*, *cavæ*, *annulata*, *punctilucens*, *splendens*, and *histrio*. Elongated spotted forms are not uncommon, but none of the oval forms with ample mantles as yet recorded are striped.

5. The branchiæ range from 5 to nearly 30 in number, and are variously arranged in a complete circle, or a circle more or less open behind or a double spiral (see Plates XXIII. figs. 2 & 8; XXIV. fig. 2). Sometimes the plumes are uniform in size; sometimes those in front (more rarely those behind) are larger. Typically they are quite simple, but frequently some are bifid and sometimes several branches are developed (e. g. *Chr. tryoni* and *striatella*). But when this occurs the ramifications are thin and irregular, and

* [I observed this change of shape in some of the species here dealt with during life.—C. C.]

the plumes do not resemble the ample and elaborate rosettes of *Archidoris*, *Platydoris*, &c. The arrangement and the approximate (but not the exact) number of branchiæ will probably be found good specific characters in cases where a sufficient number of individuals has been examined; but I think that the number of plumes increases with age, at any rate in some species, and that hence the data furnished by a single specimen may be misleading. This is the case particularly in forms with a spiral arrangement, where it seems likely that the small plumes in the spire are developed later than the others. Thus in *Chr. sykesi* the number varies from 12 to 18 and in *Chr. annulata* from 9 to 16. In the latter species a spire is present in some cases and absent in others. The commonest number of branchiæ seems to be about 10 (varying from 8 to 12 in individuals). A distinctly smaller number (3 to 7) is found in *Chr. cardinalis*, *juvenca*, *elegantula*, *iheringi*, *krohnii*, *virginea*, *gloriosa*, *scurra*, *luxuriosa*, *albonotata*, *inconspicua*, *elegans*, *camœna*, *rudolphi*, *pantharella*, and is indicated in the drawings of many other species. In *Chr. punctilucens*, *lineolata*, *paupera*, *tryoni*, *bennetti*, *splendens*, *crossei*, *dalli*, *reticulata*, *godeffroyana*, *mollita*, *vicina*, *sykesi*, and *annulata* the number of plumes is more than 12 and often exceeds 20.

I have observed that in making a superficial examination of the living animal one is very apt to under-estimate the number of branchiæ, inasmuch as the longer ones may project and the shorter ones be hidden. Hence the plates and descriptions of older authors cannot be considered as decisive on this point.

6. The labial armature consists sometimes of two plates and sometimes of a continuous ring. The elements are hardly ever straight, but are more or less bent or hooked. They are of very varying shape and thickness, and sometimes swollen just below the tip or terminal hook, so that they assume a mace-like appearance. The shape usually affords a good specific character, but in some species the elements are bifid in one part of the armature and entire in another.

7. The radula offers many differences. *Chr. scabriuscula* has a central tooth and *Chr. juvenca* a central plate which is called "false" by Bergh, though it seems well developed. Rhachidian thickenings, more or less distinct, are found in *Chr. cœrulea*, *iheringi*, *mörchii*, *gonatophora*, *porcata*, *carnea*, *mariana*, *hilaris*, *sannio*, *lineolata*, *marenzelleri*, *cardinalis*, *reticulata*, *dalli*, *cavæ*, *annulata*, *splendens*. The radula is as a rule of moderate size, but is very narrow in *Chr. elegantula*, *krohnii*, *gloriosa*, and rather narrow in *pustulans* (75 × 28.0.28) and some other forms. In *scabriuscula* it is 108 × 30.1.30. It is unusually broad in *thalassopora* (71 × 162.0.162), and above all in *sycilla* (81 × 290.0.290).

The formulæ for the radula given in my descriptions are merely the shortest way of describing the teeth of a given specimen, and must not be understood as necessarily characteristic of the species. The proportion between length and breadth is generally roughly the same in different individuals, but the number of rows and of

teeth in them varies greatly and apparently increases with the size (that is probably the age) of the animals.

As regards shape, the teeth present several types :—

(1) They are simply bifid in *cærulea*, *semperi*, *nigrostriata*, *marenzelleri*, *crossei*, *thalassopora*, *camœna*, *lapinigensis*. In these species the innermost tooth bears a single accessory denticle on the inner side and hence appears trifid.

(2) They are bifid with accessory denticles below the bifurcation in *gracilis*, *messinensis*, *sycilla*, *hilaris*, *bennetti*, *californensis*, and *agassizi*. In *runcinata* the accessory denticles are very small and inconspicuous.

(3) In *scurra* the apex of the tooth is three or five times cleft, and a somewhat similar arrangement, by which the denticles are all on the upper part of the tooth, appears to occur in *pustulans*, *gloriosa*, and *rudolphi*.

(4) The commonest form of tooth is hamate, with several (6–10) denticles on the outer side. These are generally fine and minute, but in some forms (e. g., *porcata*, *rosans*, *mariana*, *elizabethina*, *paupera*, *tryoni*, and *godeffroyana*) are large and strong. In this class of radula the innermost teeth have generally several denticles on each side, but sometimes (e. g., *mörchii* and *gonatophora*) only one on the inside.

Of the species described below, the first four are closely related, and form a group to which I am almost disposed to accord generic rank. I have not done so out of deference to the high authority of Prof. Bergh, as one of the animals appears to be identical with the *Goniobranchus reticulatus* of Pease, examined by him and referred to *Chromodoris*. All four forms agree in being oval and flat in shape, with a very ample mantle-margin. The consistency is very soft, and the dorsal pattern composed of spots, not stripes. The innermost teeth of the radula bear a few denticles on both sides; the rest 6–10 denticles on the outer side only. The branchiæ are numerous, and the sides of the mouth are connected with the upper lamina of the grooved foot. This latter peculiarity was noted in the living as well as in the alcoholic specimens; but I am not sure that it is of much morphological significance, for in a very soft animal with ample flaccid integuments such folds may easily be formed at the corners of the mouth without constituting distinct structures.

Nos. 12–15, described as *hilaris*, *lineata*, *lineata* var., and ? *magnifica*, are very likely all varieties of one striped species, with bifid teeth bearing accessory denticles, and about 10 branchiæ, but a larger number of living animals must be examined before this identity can be established.

All my species which are not new have been previously found in the Indo-Pacific, which appears to be the head-quarters of the genus, though not enough is known of the Nudibranchs of the tropical Atlantic to make any comparison as to numbers of species. About half a dozen forms are reported from the West Indies and the Gulf of Mexico. The genus is mainly tropical, and in

Europe is not found north of the Mediterranean. In the Pacific it extends to Japan and Puget Sound.

1. CHROMODORIS RETICULATA Pease. (Plate XXIII. figs. 1–5.)

[See Bergh, "Neue Nacktschnecken, No. iv.," Jour. Mus. Godeffroy, Heft xiv. p. 9 ff.]

Four specimens, found at different times on both the East and West Coasts of Zanzibar at low tide.

The colour and size vary considerably. The following is the description of one living specimen:—"23 millimetres long, 12 wide. Foot narrow, with the sides crinkled. Mantle-edge fairly ample and undulated. The whole animal very soft and almost gelatinous. The dorsal surface whitish, with numerous red reticulations, which became closer at the edge and formed a red border. Outside this was a yellow border, passing over to the underside. The rhinophore and branchial openings were not raised. The rhinophores were crimson-lake, with fine white lines on the perfoliations. The branchiæ were of a transparent light pink, with two lines of crimson-lake down the main axis. The under surface of the animal was of a beautiful opaque white. The foot projected behind the mantle."

Another specimen (67 millimetres long and 30 broad) was described as much lighter than that just noticed, but having similar lines and reticulations; there was no crimson-lake and no red border; all the red and yellow markings were bright and light. It was infested with violet-coloured copepoda.

On the other hand, two other specimens were of a much darker colour. The general effect was reddish brown, due to a close reticulation of that shade on a dirty-white ground. The mantle-border was a dark reddish orange. The gills were of a very deep colour, and in one specimen almost black. The pinnæ were so thick and swollen that until closely examined each plume appeared to be a simple column.

The alcoholic specimens are flat, smooth, and very soft. The branchial openings are fairly large, but in the living animal were capable of contracting and almost closing. The branchiæ are 22 to 24 in number, set in an incomplete circle with the ends turned inwards in a spiral (Pl. XXIII. figs. 2 & 3). The front plumes are long and slender, while those behind in the spiral are very small. Hence on a superficial examination only 10 or 12 are visible. The foot is rounded and grooved anteriorly, and the upper lamina is connected with the sides of the mouth (Pl. XXIII. fig. 1). Near the points of junction appear to be two indistinct retracted tentacles.

The labial armature is a dense mass of long rods, slightly curved and bifid at the end. On the rhachis of the radula * are transparent lozenge-shaped thickenings. The innermost teeth

* Only one preparation of the radula has been preserved from one of the darker specimens.

next to the rhachis bear 3–4 small denticles on each side, and those nearest to them are somewhat similar but denticulate only on the outer side; the others are long and hamate, with about 8 denticles on the outer side (Pl. XXIII. fig. 4, *a*, *b*, *c*). The outermost bear 3–4 denticles on the apex. A drawing of the alimentary canal is annexed (Pl. XXIII. fig. 5).

I think these animals can be referred to *Chr. reticulata* Pease, with which Collingwood's *Chr. alderi* seems to be identical. All my specimens are flat, with ample mantle-margins, and this agrees with Collingwood's description and plate. Bergh, on the contrary, says: "Die Körperform ist länglich nicht sehr niedergedruckt . . . der Mantelsaum ziemlich schmal." But these soft Chromodorids have great powers of changing their shape and proportions. The branchiæ are much more numerous than in the specimens previously described, but a multiplication of the small plumes in the spiral does not appear to constitute a specific difference.

2. CHROMODORIS SYKESI. (Plate XXIII. fig. 6.)

Chromodoris sykesi Eliot, Abstr. P. Z. S. 1904, No. 4, p. 15, March 8.

Numerous specimens from the East Coast of Zanzibar, obtained both on the shore and by dredging. A few of the animals were of a reddish brown with dirty yellow markings, but in the majority the coloration was most gorgeous (Pl. XXIII. fig. 6). The dorsal surface was bright orange, passing into light yellow towards the edge of the mantle, round which was a double border of reddish brown internally and bright violet externally. On the back were numerous rings of opaque white, but otherwise the whole body was translucent. The foot and underside of mantle were of a rich light yellow. The rhinophores and branchiæ were both of a deep brown-red with opaque white spots. The perfoliations of the rhinophores were indistinct, and the pinnæ of the branchiæ small though made conspicuous by white lines drawn along them. The animal was rather flat and very soft. The mantle was very ample.

The largest alcoholic specimen is 40 mm. long, 27 broad, and 10 high. The free edge of the mantle measures 7 mm. over the head, 10 at the sides of the body, and 13 over the tail. In giving the measurements, the breadth of the body is estimated as the mantle falls in its normal position: the edge of the mantle is taken as extended, but not stretched unnaturally. The openings of the rhinophores and branchiæ are small and only slightly raised, but the interior of the branchial pocket is a capacious and very strong bag. The branchiæ are arranged as in *Chr. reticulata* and vary from 12 to 18, according to the size of the spiral. They are red and striped with white. The anal papilla is tall, red and spotted with white. The foot is rounded and grooved in front. Two rather strong folds connect the upper lamina with the corners of the mouth. The oral tentacles were not distinctly

developed in any specimen, but in some there were bulges which may represent these organs in a state of contraction. The labial armature is a strong, rough yellowish ring; it consists of fairly long rods, hooked at the end. The radula is deep red; the formula is about 55 × 50.0.50. The innermost teeth have a moderately broad central cusp, with two or three denticles on the side nearest the rhachis and five or six on the outer side. The next two or three teeth are much like them, but are denticulate only on the outer side. The other teeth are long and hamate, with from six to ten minute but distinct denticulations on the outer side only. The outermost teeth retain their form fairly well, though they are smaller than the others.

This beautiful species is dedicated to my friend Mr. E. R. Sykes as some slight acknowledgment for the invaluable assistance he has rendered me in seeing my papers on the Nudibranchiata through the press.

3. CHROMODORIS CAVÆ. (Plate XXIII. figs. 7 & 8.)

Chromodoris cavæ Eliot, Abstr. P. Z. S. 1904, No. 4, p. 15, March 8.

Several specimens from the East and West Coasts of Zanzibar.

The following are the notes on the living animal:—"Colour yellowish white, with indefinite large drab blotches laterally. Edges of mantle and foot bordered with light violet. On the back are black spots surrounded by a white line and also irregular dull orange spots. The foot is not very broad, white in colour, with a row of dull orange spots and black spots below them. The tip and anterior side of the rhinophores are purple; the lamellæ are reduced to fine striations. The margins of the rhinophorial and branchial pockets are not at all raised; the rhinophores and gills when retracted are not completely out of sight. The mantle is ample. The skin is quite smooth and even. In captivity the animals sometimes swim on the surface of the water, foot uppermost."

The measurements of the largest alcoholic specimen are:—Length 60 mm., breadth 34 mm., height 14 mm., free edge of mantle 10 mm. over the head, 9 mm. at sides of body. The branchiæ (Pl. XXIII. figs. 7 & 8) vary from 12 to 16. Ten are fairly large and form a circle open behind. On the inside of this circle are set on either hand from one to three smaller plumes. The foot is grooved in front and the upper lamina is attached to the side of the head. The mouth is a very distinct vertical slit, and at its lower corners, just about the point where the lamina of the foot terminates, are a pair of fairly well-developed tentacles. The labial armature is a not very compact mass of long bent rods, not bifid at the end. The rhachis of the radula bears transparent lozenge-like thickenings, which are, however, not very distinct. There are about 60 rows containing about 70 teeth on each side of the rhachis. The innermost are much as in *Chromodoris sykesi*, but the central cusp is broader and there are about 5 denticles on the

outer side. The second and third are much like the innermost, but are denticulate on the outer side only. The rest are simply hamate, of the ordinary shape, and bear about 10 minute denticles. The outermost are, as usual, irregular, and the denticulations are mainly on the apex.

4. CHROMODORIS ANNULATA. (Plate XXIV. figs. 1–3.)

Chromodoris annulata, Eliot, Abstr. P. Z. S. 1904, No. 4, p. 15, March 8.

Many specimens found among *Zostera* off the mouth of the Creek at Zanzibar and other places at low water during spring-tides.

The living animal (Pl. XXIV. fig. 3) was very soft, with an ample undulated mantle-margin. A large specimen when in an extended condition was 55 mm. long and 15 wide, but when contracted the same individual was 45 mm. long and 25 wide. The upper surface was of a somewhat translucent white, studded with yellow spots. Round the margin was a border of deep purple, and two rings of the same colour were so placed as just to include the rhinophores anteriorly and the branchiæ posteriorly within their respective areas. The underside was white, with yellow spots on the tail and the sides of the foot. The rhinophores were deep purple, and so long that they were rarely wholly retracted. The branchiæ were white, with a deep purple stripe down both the inner and outer edge, and were kept waving from side to side. The animals were found in conspicuous positions, and made no attempt to hide themselves among the *Zostera* weed.

By a somewhat unusual change, which deserves to be noticed as showing how preserving-fluids may alter colour, the alcoholic specimens have become of a reddish purple with white spots, the border and rings having disappeared * and apparently diffused their pigment over the whole surface. Fortunately the notes on the living animal were very full, and there appears to be no doubt that the specimens are the same despite their transformation. The body is very soft and the skin perfectly smooth. The mantle is ample, the free edge measuring 7 mm. over the head and 6 at the side in a specimen where the visceral mass is 10 mm. broad. The openings of the rhinophores and branchiæ are slightly raised in some, but not in all the specimens, and vary in size. They are no doubt capable of contraction and expansion in life. The branchiæ (Pl. XXIV. fig. 2) vary in number from 9 to 16 according as an inner row is present or not, but on an average the smaller number is more frequent in this species than in *Chr. reticulata*, *sykesi*, and *cavæ*. The foot is narrow and rounded, grooved in front but not notched. Two small folds pass upwards from the foot, uniting it with the sides of the head and with the mantle. The tentacles are small and placed at the lower angles of the mouth. The labial

* [Their dark purple-blue became almost at once a light red, which disappeared gradually.—C. C.]

armature is formed of two large strong triangular plates, almost united into a ring, dark brown, and formed of a mass of long hooks. The rhachis of the radula (Pl. XXIV. fig. 1) bears lozenge-shaped thickenings, on each side of which are about 45 teeth. The number of transverse rows is about 70. The innermost teeth have a large denticle on the inner side, and three small ones on the outer; the rest are simply hamate, with 8–10 minute denticles; the outermost irregular and denticulate on the apex in the younger rows, but in the older the denticulations seem to have been worn off.

5. CHROMODORIS SPLENDENS.

Chromodoris splendens Eliot, Abstr. P. Z. S. 1904, No. 4, p. 15, March 8.

[? = *Chr. splendida* Angas, Journal de Conch. i. 1864, p. 55.]

Two specimens from Chuaka, East Coast of Zanzibar. The notes on the living animal are as follows:—"General colour somewhat miscellaneous, being produced by thick collections of purple and white dots, in different proportions in different places. A vivid orange border round the whole body. Underside milk-white. Mantle ample. Gill-pocket fairly large, gills purplish."

The alcoholic specimens are of a uniform dirty yellow, and of about the same size. Length 40 mm., breadth 13, height 10. The free portion of the tail is 6 mm. long, but is entirely covered by the mantle, the free margin of which measures 7 mm. behind and 5 mm. at the sides and head. The rhinophores are large. The edge of the branchial opening is slightly raised. The total number of branchial plumes is 27, but of these three seem to be accessory ramifications and not independent branchiæ. The circuit is open behind, and the two ends are turned inwards in a spiral. The anterior plumes are large, and those in the spiral very small, so that the living animal shows ten or twelve branchiæ. The foot is rather wide, with thin margins, and is dilated and deeply grooved in front. The tentacles are distinct. The inconspicuous labial armature consists of two small yellowish plates, composed of fairly long bent rods, most but not all of which are bifid. The radula is also yellowish, with about 70 × 60.0.60 for formula. On the rhachis are indications of triangular thickenings, but the base of the triangle is not distinct. The innermost teeth bear three or four denticles on the inner and five on the outer side. The rest are hamate, rather erect, with six denticles under the hook decreasing in size downwards. The outermost show less difference from the rest than usual, and are long, erect, with about four denticles on or near the apex.

I think it very probable that this is the animal described as *Goniodoris splendida* in the 'Journal de Conchyliologie,' and I have indicated this probable identity in the name. The scheme of coloration is very similar, and the ample mantle, large rhinophores, and numerous branchiæ are also points of resemblance, but the purple in the present specimen is distributed in the form

of small dots, and not collected into large spots. But it is possible that the buccal parts of *Chr. splendida*, respecting which we have no information, may present specific differences, and identification is therefore at present not warranted.

6. CHROMODORIS TRYONI (Gar.) var. (= *Chr. aureo-purpurea* Collingwood).

[See Bergh, "Neue Nacktschnecken, No. iv.," Jour. Mus. Godeffroy, Heft xiv. p. 14 ff.]

Two specimens from Chuaka, the larger of which was about three inches long in life. The body was quite smooth and very soft. The mantle and edge of foot bordered with light violet; the back translucent, allowing a rough, broad, net-like grey pattern to be seen beneath the surface; the whole surface covered with opaque spots of bright orange-yellow. Foot broad and deep, with white sides bearing orange-yellow spots. The rhinophores with purple lamellæ and a longitudinal white stripe behind. The simply pinnate branchiæ white, with a deep purple stripe down each edge*. The animal was lively in its movements, and the branchiæ continually waved with a quick vigorous motion from side to side.

The alcoholic specimen is 35 mm. long, 13 broad, and 15 high, stoutly built, with a narrow mantle-edge of only 3 mm., and the tail projecting 8 mm. behind. The edges of the rhinophore and branchial pockets are slightly raised. The branchiæ seem to be 27 in number, the median anterior plume being the largest. The circuit is interrupted behind, and the ends of the row of plumes turned inwards in a spiral. Several of the plumes are bifid at the tip. The anterior margin of the foot is slightly grooved but not notched. The labial tentacles are very small and set somewhat above the mouth. The lips are large. The labial armature consists of two strong, rough plates composed of a closely-compacted mass of small thick hooks. The long white radula has 96 rows of colourless teeth, containing about 50 teeth on each side of the rhachis, which exhibits folds and puckers. The teeth have the characters usual in the genus; the innermost bear four denticles on both sides, the others five large and distinct denticles below the terminal hook on the outermost side only, the highest being the largest. In the outermost the denticles move upwards, till they are all on the apex of the teeth. The form of the teeth and labial armature is accurately represented in Bergh's plates.

I think this form may be safely identified with *Chr. tryoni*. It differs from Bergh's description only in the absence of ocelli with black centres. It appears to be also identical with Collingwood's *Chr. aureo-purpurea*, though the latter is said to have only 10 branchiæ. The two varieties may be described as *Chr. tryoni* var. *ocellata* and var. *aureo-purpurea*.

* [I quote from the notes on the living animal, but must admit that this expression is obscure. (Outer and inner sides, parallel with blood-vessels shown in fig. 3, Pl. XXIII.—C. C.)]

7. CHROMODORIS VICINA.

Chromodoris vicina Eliot, Abstr. P. Z. S. 1904, No. 4, p. 15, March 8.

Twelve specimens from Chuaka.

The following notes were made on the living animal:—

"Mantle and foot bordered with light violet, the latter border a row of dots. Middle of back drab-brown with bright violet spots, the larger ones with a white centre. Near the edge of the mantle a number of yellow spots with white borders, which are often confluent. The foot deep and narrow, white with some yellow spots near the lower edge. The rhinophores dark brown with white tips. Each of the branchiæ bore two black bands."

The alcoholic specimens are of a dull reddish brown and present two very different forms: one long and narrow, measuring 37 mm. in length and 9 mm. in breadth, and the other oval, being 27 mm. long and 20 broad. Both are about 20 mm. high. The margin of the mantle is about 6 mm. wide, and forms a sort of hood over the head. The branchial opening is very small. Both it and the rhinophore openings are slightly raised. The branchiæ are 16 in number, the circuit is open behind, and the row of plumes turns inwards in a small spiral. The foot is long and narrow. In the long form of the animal it projects about 5 mm. beyond the mantle; in the broad form it is covered by it. The anterior margin is rounded and grooved, but not notched. On each side of the mouth is a small conical tentacle.

The labial armature consists of two yellowish plates composed of rather long rods, bifid at the tip and generally bent into the form of hooks, but sometimes straight. These are much like the same organs in *Chr. striatella* (*vide* Bergh, 'Challenger' Reports). The formula of the radula is about $50 \times 45.0.45$. The rhachis is bare but exhibits in places a slight wavy fold. The innermost teeth bear three denticles on each side of the central cusp. The next two or three are of much the same shape, but denticulate only on the outer side. The majority are tall and straight, bearing five large and distinct denticles under the terminal hook, and sometimes two or three small irregular denticles in addition. The five or six outermost are irregular in shape, and bear from three to six irregular denticulations mostly on the apex.

This species is closely allied to *Chr. tryoni*, and will not improbably prove to be a mere variety of it. All the present specimens, however, have a somewhat different coloration, fewer branchiæ, and more numerous denticles on the teeth.

8. CHROMODORIS ELIZABETHINA B., var. AFRICANA. (Plate XXIV. fig. 4.)

Two specimens from the East Coast of Zanzibar. The notes on the living animal describe the dorsal surface as black and white, black preponderating. The mantle had a double border, yellow

outside and white inside, as had also the foot. In the middle of the back were two longitudinal white lines uniting behind the branchiæ; on the tail, which projected well behind the mantle, was one white line. The gills and rhinophores were yellow, and the slightly raised pockets of both were fringed with the same colour. The creeping-surface of the foot was narrow. The sides of the body were black with a white stripe between the mantle and the foot.

The alcoholic specimens are high and stout, with the colours fairly well preserved. The largest is 26 mm. long, 13 broad, and 10 high. The mantle-margin is fairly ample, measuring about 3 mm. at the sides and head, 5 mm. over the tail. Of the branchial plumes there is only one which can be called simply pinnate in the strict sense, all the rest being more or less bipinnate. Some are merely bifid, and some bear four or five branches. It is rather difficult to say what is the number, as when a small plume springs up at the base of a large one it may be counted either as an accessory branch or as a separate branchia, but they may perhaps be described as 10, set in a semicircle. The foot is grooved and notched in front; the tentacles are close together above the mouth, conical and larger than usual in the genus. The labial armature is greyish and formed of a thick mass of bent rods, some bifid but most simple. The formula of the radula is in one specimen $94 \times 90.0.90$ and in the other $90 \times 75.0.75$. The innermost teeth bear three denticles on both sides; the remainder 3–4 minute denticulations on the outer side only, and some are quite smooth and simply hamate.

I think these specimens may be referred to Bergh's *Chr. elizabethina* (S. R. xi. pp. 466–473). The difference in appearance, though striking, is due to the relative preponderance of black in one and of white in the other variety. The dentition and the tendency to bipinnate branchiæ are strong points of resemblance. On the other hand, the differences found in both the African specimens are sufficient to constitute a well-marked variety. (1) Whereas the specimens from the Philippines are whitish with black stripes, these are black with white and yellow stripes. (2) The denticles on the teeth of the African specimens are fewer and finer and many of the teeth are smooth.

9. CHROMODORIS RUNCINATA B.

[Bergh, in S. R. xi. pp. 479–481.]

One specimen from Chuaka on the East Coast of Zanzibar.

The general colour of the living animal was light blue with many spots, some dark blue and some whitish yellow, on the back, tail, and sides, but not on the foot. Some of the yellow spots were arranged so as to form a rather irregular border at the sides of the mantle and a line down the middle of the back. The rhinophores and axes of the gills were a bright, light red. The gills were kept in motion.

The alcoholic specimen is high and stoutly built; length 14 mm., breadth 5, height 6. The mantle is moderately ample; under its posterior margin it bears eight conical protuberances, four of which are very distinct and the rest smaller. There are none, however, on the anterior portion of the mantle as in the specimens described by Bergh. The branchiæ are 12 and exposed in the preserved specimen. The foot is rounded in front and strongly grooved. The labial armature and radula are much as described and figured by Bergh. The formula of the latter is about 50 × 70.0.70. The teeth are bifid; the innermost bear an accessory denticle on the inner side and hence appear trifid. The others bear two or three very fine denticulations below the two prongs. The outermost have 5–7 rather larger denticles.

A second specimen subsequently examined has also only a few conical protuberances behind and none in front, so that this peculiarity is perhaps characteristic of East African specimens.

10. Chromodoris nigrostriata. (Plate XXIV. figs. 5 & 6.)

Chromodoris nigrostriata Eliot, Abstr. P. Z. S. 1904, No. 4, p. 15, March 8.

One specimen from the mouth of Chuaka Bay, found among the branches of growing coral at extreme low tide.

The living animal was 15 mm. long and 3 broad when fully extended. The foot was broad and high; the mantle-edge was narrow, and in the alcoholic specimen has become a mere low ridge. The ground-colour was a violet-blue grey, with rather ill-defined blotches of light primrose-yellow on the back, mantle-edge, and sides of the foot. On the back and sides of the foot were also very distinct curved black lines, one of which formed a horseshoe round the gill-pocket, while the rest were arranged in a nearly symmetrical figure. The edges of the rhinophore and gill-pockets were not raised. The gills were seven and completely retractile into a pocket which could close over them. The separate plumes were orange-red, but the rather large basal part, where they were all united, was of the same violet-grey as the body. The rhinophores were of a rather deep red.

The alcoholic specimen is of a uniform bluish grey; the yellow blotches have disappeared, but the black lines are very distinct and vivid. The rhinophores are large, and of the seven gills three appear to be much larger than the others, which is not apparent from the drawings or descriptions of the living animal. The tentacles are entirely withdrawn and only indicated by two puckers, one on each side of the mouth. The front of the foot is round, and no groove is visible. The anterior part of the body has been torn, with the result that the buccal parts have been injured. The labial armature is a mass of thick stout hooks, shaped much as in Bergh's figure of *Chr. semperi*, arranged in a regular tessellated pattern. The radula, which seems small and brittle, is much damaged. No rhachis or rhachidian teeth are

discernible. All the teeth which I examined were hamate, with bifid tips, exactly like those of *Chr. semperi* as figured by Bergh.

Another specimen captured at Chuaka, on the East Coast of Zanzibar, seems to belong to the same species, though at first sight is strikingly different from the individual described above, being larger, stouter, and of another colour. The notes on the living animal describe it as lemon-yellow, with very deep purple-black stripes; the gills and rhinophores vermilion; the foot purplish underneath and at the edges.

The preserved specimen is pale yellow, with black lines arranged much as already described, including a horseshoe round the branchiæ, but shorter and more numerous. It is 30 mm. long, 15 high, and 13 broad. The mantle-edge is a narrow thick ridge, measuring 1·5 mm. at the sides, 2·5 over the head, and 3 over the tail, which is 10 mm. long. The body is high and thick, but the sole of the foot narrow (maximum 3 mm.). The pockets of the rhinophores and branchiæ are small and very slightly raised. The branchiæ are ten, set in a complete circle, but the anterior plumes are larger than the posterior. One of the latter is very small and perhaps merely an offshoot. The foot is rounded in front, grooved but not notched. The tentacles are retracted and hardly visible.

The labial armature is yellowish and formed of short thick hooks. The formula of the large and closely-packed but very fragile radula is about 90 × 75.0.75. The teeth are mostly bifid at the tip and otherwise smooth. Only the innermost have an accessory denticle on the inner side, and are thus trifid. The outermost are serrulate at the apex.

These two specimens seem to be merely colour-varieties of a single species which is closely related to *Chr. semperi* B. Except that the external teeth of the radula bear more numerous and more distinct serrulations, the principal characters appear to be identical. But whereas *Chr. semperi* is spotted, the animals here examined are marked with exceptionally clear and narrow black lines, which seem engraved on the surface. They must therefore be accorded specific rank, at least provisionally. It is possible that intermediate forms may be discovered, as the variety first described bears some yellow blotches.

11. CHROMODORIS SCURRA B.

Chromodoris scurra Eliot, Proc. Acad. Nat. Sci. Philadelphia, Dec. 1899, p. 518.

[Bergh, S. R. xi. p. 478, and Journal de Mus. Godeffroy, Heft vi. 1874.]

Two specimens from Zanzibar Harbour.

The colours of the living animal are brilliant. Down the centre of the back runs a white line, and on each side of it are borders in the following order: (1) narrow deep red line, (2) broad orange-yellow band, (3) narrow deep red line, (4) violet band, which broadens out anteriorly and posteriorly, (5) white border running

round the mantle. The foot is of a light violet-blue; the branchiæ orange with deep violet tips; the rhinophores uniform deep violet. The animals are sluggish and not very sensitive to touch.

The buccal parts and other characters are as described by Bergh. One specimen has six branchiæ, the other eight, of which one was posterior to the others and very small.

12. CHROMODORIS HILARIS B., var. (? =*lineata* Soul.)

[S. R. xvii. pp. 935–937.]

Nine specimens from Tundaua, Pemba, found on a sandy shore.

The description of the living animals is as follows:—"Creamy white. Foot and mantle edged with violet. On the back four undefined brown lines with three violet lines between. Foot projects behind mantle. Gills and rhinophores vermilion. About 1½ inches long."

The preserved specimens are longish and not very stoutly built. The measurements of the largest are: length 25 mm., breadth 10 mm., and height 9 mm. The colour is the ordinary alcoholic yellow; on the back are traces of four brownish and three white lines, the latter representing the violet of the living animal. Some, but not all, of the specimens appear to have a similar white line on the sides of the body between the mantle and the foot. The branchial aperture is very small; the branchiæ themselves not very small and 10–12 in number. The foot is rounded in front and slightly grooved. The tentacles are distinct. The mantle-edge is of very varying shape, sometimes fairly wide and thin, sometimes merely a thick ridge.

The labial armature and radula are much as represented in Bergh's plates. The former is a grey ring composed of mace-like elements. The latter is small and transparent. Most of the teeth are bifid, with four or five accessory denticles below the two prongs. The innermost have one or two denticles on the inner side. The rhachidian thickenings are small and not very distinct.

Bergh's specimen was in life "hell ocker-gelb" with four bluish-black lines on the back, but on the whole the colour and markings are sufficiently similar to justify us in regarding the present specimens as merely varieties.

13. CHROMODORIS LINEATA Soul. (? = *Chr. hilaris* B.) (Plate XXIV. fig. 7.)

One specimen from the East Coast of Zanzibar.

The notes on the living animal are as follows:—"Cream-coloured. Gills and rhinophores vermilion. There were bright violet lines on the cream-yellow ground, bordering the foot and mantle: two along the sides of the body and five along the back. The two outside ones encircled the rhinophore-pits and joined in front; the median encircled the gill-pocket."

The alcoholic specimen is yellow and the violet lines have become white. It is high and stout, the dimensions being—length

15 mm., breadth 7, height 8. The mantle-edge is narrow except over the head, where it is ample. The branchial opening is minute; the branchiæ are small, 10 in number, and apparently set in a perfect circle. The foot is rounded and grooved in front; the shape of the head is spatulate. The labial armature is a yellow ring of mace-like elements. The radula is small and transparent, the formula being about 35.0.35 × 80. The ordinary teeth are bifid, and all appear to have four denticles under the top hook. The innermost have one or two denticles on the inner side. The outermost are irregularly serrate (*vide* Pl. XXIV. fig. 7). No rhachidian thickenings are to be seen.

Although the published plates of *Chr. lineata* and *Chr. hilaris* are remarkably different, the scheme of coloration is much the same; and I think it probable that the two forms are really varieties of one species.

14. CHROMODORIS ? LINEATA, var. NIGROLINEATA.

One specimen from Chuaka on the East Coast of Zanzibar.

The notes on the living animal are as follows:—"Shape spatula-like. Dorsal side whitish at edges, lemon-yellow medianly with longitudinal black lines. Gills and rhinophores short, orange-red. Underside colourless, but edge of foot and mantle bright dark blue (not purple)." Size 18 mm. long, 6 mm. broad.

The alcoholic specimen is of a waxy white. There are only faint traces of the blue borders, but there are five distinct black lines on the back, two of which are divided again so as to form long loops. The mantle-edge is thick and narrow. It measures about 2 mm. over the head and tail, but is hardly distinguishable at the sides. The anterior end of the foot is rounded and grooved. The small branchiæ are set in a circle and exposed. The buccal mass is small. The labial armature is transparent, and consists of rather irregulor short hooks, some cleft. The small transparent radula is as in *Chr. hilaris*.

15. CHROMODORIS ? MAGNIFICA Q. & G., var.

One specimen from Zanzibar, dredged in 4 fathoms.

The following are the notes on the living animal:—"40 mm. by 10 mm. Elongate in form, fore end spatula-shaped. Colour white and rather translucent. Mantle with a thin yellow border, within which was a band of deep but brilliant violet, broadest in front and behind but broken laterally. There was also a violet line along the sides of the foot, and six longitudinal lines of deep chocolate-colour and different lengths along the back. They were surrounded by thin clear lines of opaque white. There was also a line of chocolate blotches along the side of the foot just below the shelf-like edges of the mantle. Branchiæ 10, simply pinnate, with a band of orange-red along each side of each plume. Rhinophores a deeper tint of orange. The tail projected well behind the mantle and bore chocolate blotches."

The alcoholic specimen is of a pale yellow, with the above-

described markings fairly well preserved but all white. The form is high and stout. The tail projects 6 mm. behind. The mantle-edge is narrow and very thick: it measures about 3 mm. over the head and tail, and 2 mm. at the sides. The pockets of the rhinophores and branchiæ are not at all raised. The front of the foot is rounded and grooved, the upper lamina being connected with the base of the tentacles; but, as in many other cases, it is hard to be sure that this feature is not due to contraction. The labial armature consists of two yellowish plates composed of rather large elements of varying size. The most perfect form appears to be a short thick hook, but in many cases this degenerates into a simple triangle. The formula of the radula is about $65 \times 70.0.70$. The teeth are crowded over the small naked rhachis. They are of the bifid type, and have usually 3–5 denticles under the two prongs. These denticles are smaller in the inner half of the rows, where many teeth are quite smooth, and larger in the outer half. The innermost teeth have generally, but not always, a denticle on the inner side: the outermost are irregular and jagged.

The buccal parts of this animal ally it to *Chr. hilaris* and *Chr. carnea*, and its coloration is not altogether dissimilar to the former. I think it is probably the *Chr. magnifica* of Quoy and Gaimard, though identification is uncertain in the absence of information as to the radula of that species.

16. Chromodoris inconspicua.

Chromodoris inconspicua Eliot, Abstr. P. Z. S. 1904, No. 4, p. 15, March 8.

One specimen from Zanzibar Harbour, dredged in 5 fathoms.

The living animal was translucent white, with numerous opaque white spots, and a few brown ones in the middle of the back; the rhinophores black; the gills greyish. It was stiff and sluggish, and somewhat resembled a *Phyllidia*.

The alcoholic specimen is of a uniform grey, 18 mm. long, 7 broad, and 6 high. The mantle-edge is narrow all round, including the parts above the head and tail, and is somewhat undulated. The pockets of the rhinophores and branchiæ have raised edges. The latter are small, 8 in number, and apparently set in a complete circle. The anterior end of the foot is slightly grooved. The tentacles are retracted. The labial armature is colourless, and consists of small thick hooks, sometimes bifid. The radula is also transparent. There are no rhachidial thickenings. The innermost teeth are unusually broad and square; they bear 8 denticles inside and 7 outside. The next two or three are also broader than the rest, which are slender, erect, slightly hamate, with one or sometimes two almost vertical clefts, so that they appear bifid or sometimes trifid. Below these clefts are from 3 to 5 long distinct denticles on the outer edge. The outermost teeth are tall and slender, with 3 or 4 denticles on the apex, but otherwise smooth.

This form has many points of resemblance to *Chr. albo-notata* B., but the dentition seems different.

17. (?) CHROMODORIS FLAVA. (Plate XXIV. figs. 8 & 9.)

Chromodoris flava Eliot, Abstr. P. Z. S. 1904, No. 4, p. 15, March 8.

One specimen dredged on the West Coast of Zanzibar.

The living animal was 11 mm. long and 3 wide. The colour everywhere, including the rhinophores and branchiæ, was a bright lemon-yellow. Round the mantle-edge ran a blood-red border of irregular width. The branchiæ were six, simply pinnate, and with few pinnæ. The mantle-edge was undulated and ample. The back was flat. The foot projected about 2 mm. posteriorly, and was considerably expanded in front. (From the drawing it appears to be grooved but not notched.) The animal adhered very strongly. The tentacles were hardly visible, being merely two small blunt knobs on the snout.

The specimen has unfortunately been lost, but I give the figures.

Genus CASELLA (Cuv.).

This small group, though easily recognised by its clearly marked and much undulated mantle-margin, is not distinguished from *Chromodoris* by any features of importance, and there is no sufficient reason, except convenience, to maintain it as a separate genus. The chief character is the aforesaid undulation of the fairly broad mantle-edge, and the outermost teeth of the radula are smooth instead of being denticulate on the apex. Bergh recognises three species, all from the Indo-Pacific.

CASELLA ATROMARGINATA (Cuv.).

[Bergh, Jour. d. Mus. Godeffroy, vi. 1874, pp. 102–9; id. S. R. xvii. p. 942.]

One specimen from the West Coast of Zanzibar.

The notes describe the living animal as long and tapering, with a flat back and a mantle-edge only slightly projecting but elaborately wrinkled at the sides. The foot hardly extended beyond the dorsal area. The general colour was brown, with numerous small grey spots, but towards the edge of the mantle became first yellowish and then greenish. The mantle-edge itself was defined by a very distinct black border. The rhinophores were black, with a grey line on the edge of each lamella. The gills were black and grey, set in a double spiral and kept in motion. The animal was about two inches long, and, in spite of its sombre coloration, a handsome creature.

These characters and colours are well preserved in the alcoholic specimen. The mantle is narrow both at the sides and behind, and somewhat expanded only over the head. The branchiæ are arranged in a double spiral meeting in front but leaving an open

space behind. They are 24 in number: those in front are fairly large, but the size diminishes backwards, and those in the spirals are extremely small. The head and anterior portion of the foot are much retracted, but the latter was apparently round and grooved in life.

The mouth leads into an unusually large and spacious cavity, but the buccal mass is very small, the radula minute, and the œsophagus extremely narrow. The labial armature is small but strong, with rough projecting teeth; the elements are small, yellowish, bent rods, mostly bifid. No rhachidian thickenings are visible; the innermost teeth have three denticles on the inner and about four on the outer side. The remainder have mostly five on the outer side only. The number of denticles increases towards the outside of each row, but the outermost teeth are smooth. The teeth are very small, crowded, and extremely numerous.

This specimen corresponds with previous descriptions of *C. atromarginata*, except that there are no thickenings on the rhachis of the radula and that the gills are much more numerous than in the specimens previously described. There seems to be some doubt on this point (see Bergh, Mus. Godeffr. l. c.), but the arrangement in the present specimen is perfectly clear. *Casella cincta* from Mauritius has 22 gills (Bergh, S. R. xvi. 2, p. 839), but presents differences in the coloration and buccal parts.

Genus Ceratosoma, Adams & Reeve.

This genus is rendered unique among Nudibranchs by its extraordinary shape, but in its essential characters it is closely allied to *Chromodoris*. Indeed, if one looks at one of the high, stout Chromodorids (*e. g.* the figure of *C. semperi* in S. R. Heft xi. pl. lv. fig. 2), it will be seen that one has only to somewhat prolong the tail and to thicken and develop the mantle-edge in order to obtain the characteristic shape of *Ceratosoma*. The large strong radula is like that of *Chromodoris*, but the denticles are minute and inconspicuous. The branchiæ are much divided. Bergh recognises nine species, but I have only seen the descriptions of those examined by himself (*cornigerum*, *gracillimum*, *trilobatum*, *ornatum*, *polyomma*). In Zanzibar I have inspected more than forty specimens which are apparently referable to one species, and are connected together by numerous gradations in colour and shape, though the extreme forms look remarkably different. As the five species mentioned above are distinguished by their external characters only, and offer no certain differences in the dentition or other organs, I am inclined to think they are merely varieties and that there is only one real species. It is to be noted, however, that though many of my specimens resembled the figure of *Ceratosoma gracillimum* (S. R. pl. xxv. fig. 8) the border was never red as there depicted, but always violet, and in no case did ocelli occur as in *C. polyomma*.

CERATOSOMA CORNIGERUM *.

[Bergh, Semper's Reisen, x. pp. 393 ff.; id. 'Challenger' Reports, pt. xxvi. p. 80 ff.]

Numerous specimens of *Ceratosoma*, mostly found together and apparently belonging to one species, were captured at Chuaka in February 1901. About 40 of them were preserved.

The living animals varied greatly in coloration, the ground-tint ranging from olive-green to deep chestnut-red, with gradations in each shade. On this ground were numerous dark brown spots and white mottlings in varying proportions, but it is to be noted that the variations in the ground-colour were real and did not depend on the markings. In all specimens there were a row of violet dots round the foot, and violet lines or spots on the head near the rhinophores, and generally near the branchiæ as well. The ground-colour near the edge of the foot was white. One specimen was dark green with orange-yellow spots, and in all cases there were a few yellow spots near the edge of the foot and the genital orifices.

Many of the animals were found in shallow pools, crawling over seaweed and in no way hiding themselves. They were sluggish in their movements, and had a peculiar, unpleasant, strongly aromatic odour. In many specimens the tail or the posterior dorsal process appeared to have been bitten off. Possibly the curious shape may really be a protection to the animal by enabling it to escape with nothing worse than the loss of an unimportant part when it is seized by a carnivorous foe. No instances of self-mutilation were observed.

The alcoholic specimens show considerable variation in size and proportions. Some are stout, some slender with relatively longer tails; in some the lobes are much thicker than in others. Note was taken of one living specimen which had no lobes at all; another had two lobes like horns near the rhinophores. It does not appear that these variations in size and shape correspond with any differences in the radula, branchiæ, or other organs.

The measurements of an average fine specimen are as follows:—Total length 89 mm., tail 34 mm.; extreme height to tip of posterior lobe 33 mm., extreme breadth across lateral lobes 26 mm. The posterior lobe rises 10 mm. above the level of the back, and the lateral lobes project 6 mm. from the line of the sides. The pockets of the rhinophores and branchiæ have slightly raised rims in some specimens, but not in all. The rhinophores are rather large; the club bears about 40 perfoliations on each side, and is supported on a stalk about as large as itself. The branchiæ are long and string-like; in nearly all the specimens they project from the pocket and are not retracted. The arrangement is

* In my paper on Mr. Gardiner's collection of Nudibranchiata, in the 'Fauna and Geography of the Maldive and Laccadive Archipelagoes,' I inadvertently alluded (p. 552) to *Ceratosoma polyomma* as common in East African waters. I should have said *C. cornigerum*.

variable, and does not lend itself to expression in a formula. In most of the larger specimens it is somewhat as follows:—All the branchiæ rise from a ring which forms the common support; in front and behind (where it is united with the anal papilla) it is about 4 mm. high. From it rise in front three longish separate plumes, bifid or trifid at the tip. On each side is a group of about five plumes, united together by a common portion some 6 mm. high; each plume is divided into three or four subdivisions, and each of these subdivisions is branched again.

The anterior margin of the foot is deeply grooved, but so retracted in most specimens that it is hard to see. The tentacles are also generally retracted. The buccal mass is a large elongated yellow cone, and the retractor muscles are very conspicuous. The labial armature is composed of small slender hooks, rather irregular in shape but not bifid. The large radula is supported by a stiff strong membrane, from which the teeth are not easily detached. In the larger specimens the formula is about 150.0.150 × 70. There is a slight rhachidian fold. The innermost teeth have one denticle on the inner side and 3 to 4 on the outer. The rest bear 1–3 inconspicuous denticles on the outer side only, of which the highest is the largest. The outermost teeth are degraded, but not much serrulated. In one specimen a number of irregular teeth, bifid and variously jagged, occurred in the middle of several rows. The rest of the internal organs appeared to be as described by Bergh. There is hardly any dilatation which can be called a stomach before the digestive tract enters the liver.

Genus Sphærodoris.

This genus is characterised by its peculiar dentition, simply pinnate branchiæ, and the external conformation of the mouth-parts. In outward appearance the species differ greatly, for whereas *punctata*, *papillata*, and *verrucosa* bear ridges and warts, *lævis* is smooth. Bergh classes the genus with *Orodoris* and *Miamira*, apparently on account of these warts and ridges; but it appears to me to be more nearly allied to *Chromodoris* in virtue of its simple branchiæ and its dentition, which is substantially similar, although it has peculiarities of its own. The teeth are straight, long, and thin, with a comb-like denticulation. The innermost are broader than the others and divided into two parts, one of which is smooth and the other denticulate—an arrangement which is perhaps analogous to that of *Chr. mörchii* and *Chr. gonatophora*, where the innermost teeth have one large smooth denticle on the inside and several small ones on the outside, although in *Sphærodoris* it would appear that the smooth part of the tooth corresponds to the outside.

Four species are known, all from the Indo-Pacific.

SPHÆRODORIS LÆVIS, var. VARIEGATA.

[Bergh in Semper's Reisen, Heft xvii. p. 924, 1890.]

One specimen from Mnemba on the East Coast of Zanzibar, found in the act of laying a ribbon of light violet-coloured eggs. The body of the living animal was described as firm and shiny, dark brown in colour above, with greenish and sandy patches; the underside was a lighter shade of uniform brown.

The alcoholic specimen is 31 mm. long, 20 broad, and 14 high. The foot, which is nearly as large as the body, is 28 mm. long and 15 broad. The colour is mottled-brown of darker and lighter shades. There are also bands formed of minute black spots, not very conspicuous, and arranged in an irregular pattern, particularly in the neighbourhood of the branchial opening. Though the dorsal surface cannot be described as either tuberculate or papillose, it is not, strictly speaking, smooth, but bears low irregular excrescences which resemble a marine growth. Also, there are about 10 shallow pits (?glandular) distributed at irregular intervals round the mantle-edge. Like the bands, they are inconspicuous, about 1 millimetre wide, with slightly raised edges and a black centre. The edges of the rhinophore and branchial pockets are not much raised and entire. There are 14 small but stout, simply pinnate gills, set in a circle which is slightly open posteriorly. The head is joined to the upper lamina of the foot at the sides, and there are no distinct tentacles, though two small prominences by the mouth may represent these. There is a very narrow but strong labial armature, composed of minute hooks. The radula is rather narrow, with a wide naked rhachis. There are about 70 rows, each containing about 25 teeth on either side of the centre, but the teeth mostly point towards the rhachis, and the whole arrangement is very irregular so that the usual radula formula hardly meets the case. The teeth present the form characteristic of the genus, but the innermost are somewhat wider than Bergh's figures of *S. lævis* (*l. c.* pl. lxxxviii.) and bear 7 or 8 denticles. The denticles on all the teeth are extremely delicate and fine. There is no stomach apart from the hepatic mass. The reproductive apparatus is unarmed.

This form is clearly a *Sphærodoris* (as shown by the buccal parts, head, and branchiæ), and, equally clearly, neither *S. punctata*, *papillata*, nor *verrucosa*. It undoubtedly comes very near to *S. lævis*, of which I provisionally describe it as a variety, but it varies somewhat from the type specimen described by Bergh both in the pits, which he does not mention, and in the teeth, and may prove to be a new species.

I have also examined several individuals, apparently referable to *S. lævis*, captured by the Skeat Expedition at Pulau Bidang near the Malay Peninsula. Their dentition is like that described above, and they have a few (in one specimen only two) pits, but the back is quite smooth and of an almost uniform bluish-olive colour.

Since writing the description of this species I have examined another specimen, found at Mombasa at low tide. It is strongly arched, and of a sandy-brown colour with patches of darker brown. Near the branchial opening are a few bands of minute black spots, almost invisible except under a lens. On the dorsal surface are 22 pits, scattered quite irregularly round the margin and in the middle. The preserved specimen has a small ridge between the rhinophores, not extending before or behind them, and possibly due to contraction after death. Around the branchial pocket is a circular area, marked off from the rest of the back by being somewhat flatter and lighter in colour. This feature was not found in any of the other specimens.

Genus Orodoris.

This genus, which Bergh regards as allied to *Miamira*, has the oval shape, wide mantle-margin, and tripinnate branchiæ of an ordinary Dorid. The dorsal surface bears ridges and tubercles. The mouth-parts show some affinity to *Chromodoris*. There is a labial armature composed of bent rods, and the rhachis of the radula presents thickenings. The innermost teeth are denticulate on both sides, the next few on the outer side only, and the rest are smooth.

Orodoris miamirana B.

[Bergh, "Neue Nacktschnecken," Jour. Mus. Godeffroy, Heft viii. 1875, pp. 67–71.]

One specimen from New Britain, kindly given me by Dr. Willey. It is, as preserved, of a uniform olive-green, with a few white spots on the foot and underside. The length is 58, the breadth 32, and the height 26 mm. The foot does not project beyond the mantle; it is deeply grooved in front and is broad, measuring 15 mm. across without counting the margins, which are turned inwards. The dorsal surface is arched, and the greater part of it is covered with composite tubercles. Over the head and round the edge of the mantle are many smallish tubercles roughly arranged in three rows. There is one large tubercle somewhat resembling the terminal lobe of *Miamira* over the tail, but no corresponding formation at the other end. Down the middle of the back runs a thick ridge, in which is set the large branchial opening. It bears six tubercles, one rather small one between the rhinophores, then two more small ones, followed by two large ones; then comes the branchial pocket, and behind it is another large tubercle. From this central ridge three transverse ridges, also composed of compound tubercles, run to the sides. The branchial pocket has a raised rim roughly circular but wavy in outline. Bergh gives the branchiæ as 7; in this specimen there are three on each side, an open space behind, and in front a very broad plume with a small accessory plume at its side. The anal

papilla is very large and connected with the front branchia by a membrane, from which an accessory membrane runs to the accessory branchia. The rhinophores are protected by raised tubes about 4 mm. high and covered with tubercles. The external opening of the mouth is unusually large. On each side of it is a conical well-developed tentacle pointing laterally.

The internal organs correspond with Bergh's description. There is a moderately large stomach with membranous walls, almost entirely enclosed in the liver, there being no dilatation whatever in the digestive tract before it enters this organ. Within the liver the cavity of the stomach measures about 6 mm. across, and the intestine when it issues is nearly the same size.

Genus MIAMIRA.

This curious form is of very uncertain affinities. Its elongate shape and labial armature seem to ally it with *Chromodoris*. But the teeth are uniform and hamate, without denticulations, the back bears ridges and tubercles arranged in a regular pattern, and the branchiæ are tripinnate. A unique character is presented by the lappets on the mantle-edge, with gill-like lamellæ on their underside.

MIAMIRA NOBILIS B.

[Bergh, "Neue Nacktschnecken," Jour. Mus. Godeffroy, Heft viii. 1875, pp. 53–63.]

Two specimens from New Britain given me by Dr. Willey. In one (hereafter called the first specimen) the tubercles and lobes are much ampler and more elaborately divided than in the other (or second specimen), so perhaps the two forms correspond to the typical species and variety described by Bergh. But the colour of both is the same—olive-green with a few white spots on the lower parts, and there is no difference to speak of in size. The length is 40 mm., the breadth 14, and the height 18. Down the middle of the back runs a ridge which bears obscure indications of being three ridges fused into one. It is about 6 mm. high in the first specimen, and 2 mm. in the second, and in both bears four tubercles. From the point where these tubercles arise, transverse ridges run at right angles to the side of the body and terminate each in a lateral lobe. The mantle-border is marked by a double ridge. There is a veil-like lobe over the head, which is trifid in both specimens, and another over the tail, which in the second specimen is small and simple, but in the first very large and studded with many accessory tubercles. At the sides of the body are four lobes, three in front of the branchiæ and one behind. The lateral and terminal lobes bear lamellæ on their underside in both specimens, but in neither are there any under the head-lobes. The branchial pocket is at the end of the dorsal ridge, raised and irregularly tuberculate. In the first specimen there is a very

large posterior tubercle. The openings of the rhinophores have slightly raised but smooth edges; the rhinophores themselves are long, straight, and thin, and bear about 30 perfoliations. The tripinnate branchiæ appear to be nine in number, but are so deeply cleft that it is hard to say how large a group should be taken as the unit. The foot is narrow and not very clearly marked off from the head; it is distinctly but not deeply grooved in front. The internal anatomy is as described by Bergh. Both the labial armature and the radula are bright yellow. The former consists of small rods, straight or bent, but in all cases hooked at the end and not bifid. The teeth of the radula are somewhat irregular in shape, but no denticulations are discernible; the innermost teeth close over the rhachis. The œsophagus widens out into a distinct dilatation before entering the liver.

EXPLANATION OF THE PLATES.

Plate XXIII.

Fig. 1. *Chromodoris reticulata* (p. 386). Anterior end, showing relations and proportions of head, foot, and mantle. *a*, ridge connecting head and foot; *b*, groove in anterior edge of foot; *m*, mouth.

2. Diagram of the arrangement of the gills, the positions of which are shown by transverse sections of their bases: *a*, anus.

3. A single gill cut across, showing *r.*, rachis; *b.v.*, blood-vessels; and *p.*, portions of three of the pinnæ borne on the sides of the rhachis.

4. Portions of the radula. *a*, central teeth; *b*, the form of the majority of the teeth; and *c*, those intermediate in shape and position between *a* and *b*.

5. The alimentary canal. The liver is cut away and the stomach laid open.

b. Buccal mass.
g. Gills.
l. Cut surface of liver.
ld. Ducts of liver opening into stomach.
sal. Salivary gland of right side.
st.c. Thin-walled anterior diverticulum of stomach.
st.m. Muscles in stomach-wall.

6. *C. sykesi* (p. 387). A living example.

7. *C. cavæ*, from life (p. 388). *m*, edge of mantle; *f*, edge of foot.

8. Diagrams of the arrangement of the gills. *a*, from an example which had 16 gills; *b*, from one with only 12.

Plate XXIV.

Fig. 1. *Chromodoris annulata* (p. 389). Central teeth of radula.

2. Diagram showing positions of bases of gills: *a*, anal papilla.

3. A living example. The purple border of the mantle is continuous all round, but is in this case hidden in places by the folding down of the free mantle-edge.

4. *C. elizabethina*, var. *africana* (p. 392).

5. *C. nigrostriata* (p. 394), dorsal view.

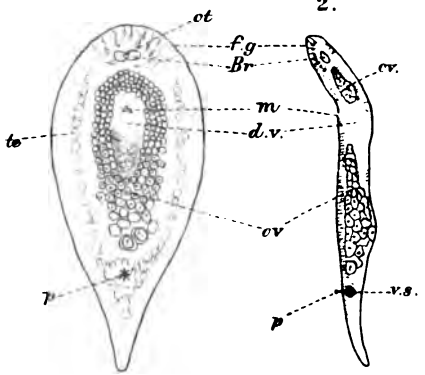
6. Side view of the same. (The number of branchiæ was in reality seven, not nine as here depicted.)

7. *C. lineata* (p. 396). Teeth of radula: *a*, from outer, and *b*, from central part.

8. *C. flava* (p. 399). Living specimen. *a*. Anterior corners of foot, which may or may not project beyond mantle-edge (*cf.* fig. 9).

9. Ventral view of the same showing narrow foot with its prolonged anterior corners and transverse groove, and proportions of head and mantle.

1.



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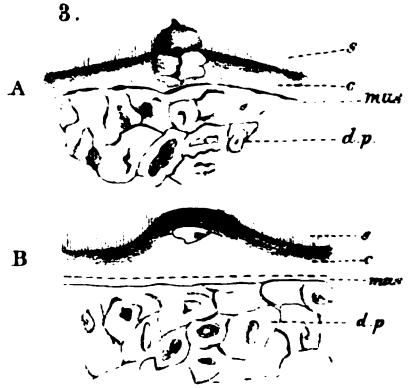

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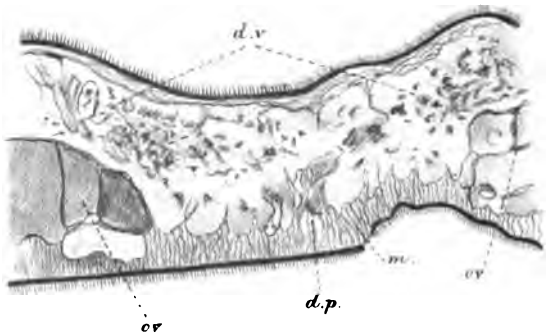

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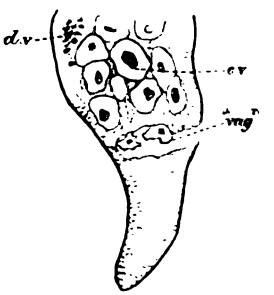

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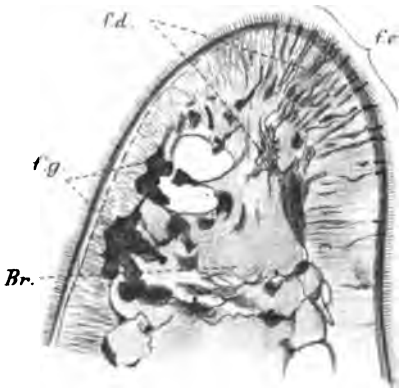

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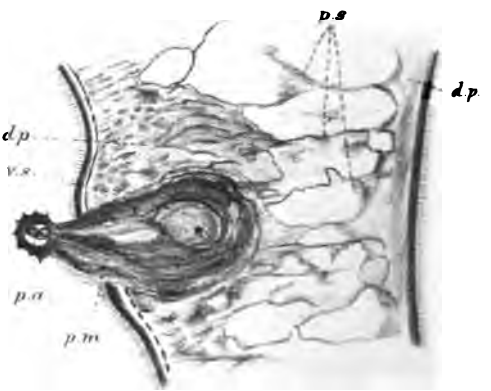

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AVAGINA INCOLA.

2. On the Turbellarian Worm *Avagina incola*, with a Note on the Classification of the *Proporidæ*. By ROBERT T. LEIPER, Research Student, Glasgow University (Embryological Laboratory)*.

[Received February 2, 1904.]

(Plate XXV.)†

The Turbellarian which forms the subject of the present paper was briefly described by me at the Meeting of the British Association for the Advancement of Science held at Belfast in 1902. The chief characters were pointed out and the name of *Avagina incola* gen. et sp. nov. given to it, in a report of that Meeting in 'Nature' (*cf.* vol. lxvi. p. 641, 1902).

It was observed by me to be present in the "accessory canal" of about five per cent. of the specimens of the common Heart-Urchin, *Echinocardium cordatum* Penn., collected from Kames Bay, Cumbrae, N.B., in the summer of 1902, and is of interest as being the only recorded example of distinct parasitism among the Acœlous Turbellaria (III.)‡.

General Features (Plate XXV. figs. 1, 2).

A. incola is whitish and moderately translucent in appearance, leaf-like in shape, obovate in outline when contracted, lanceolate when extended, the blunt end being anterior. It measures in length 2·5 mm., in breadth transversely ·6 mm., dorsi-ventrally ·2 mm., and progresses by a slow creeping spiral movement. Several examples are usually found in the same host.

Integument (Plate XXV. fig. 3).

The integument consists, as in other Acœla, of (1) a muscular network of single, circular, oblique, and longitudinal fibres abutting on the superficial parenchyma, and (2) a granular cuticle uniformly covered with cilia. Not unfrequently along the ventral surface, but seldom on the dorsum, the cuticle is swollen by vesicular structures which are sometimes surmounted by large granular projections (fig. 3, A, B). There are no rhabdites or sagittocysts.

Mouth (Plate XXV. fig. 4).

The mouth is merely an opening in the cuticle exposing the superficial parenchym. Its position on the under surface at about the junction of the anterior fourth with the rest of the body is recognisable in the living animal, even from the dorsal surface on careful focussing, by the converging action of the cilia. There is practically no pharynx.

* Communicated by the SECRETARY.

† For explanation of the Plate, see p. 411.

‡ Roman numerals in brackets refer to the List of Literature given at the end of this paper.

Parenchyma (Plate XXV. figs. 4, 6).

The parenchyma may be divided into two portions :—(1) A cellular layer, much thicker on the ventral surface than on the dorsal, with oval nuclei lying for the most part at right angles to the cuticle and staining faintly. This is known as the "dermal layer" and gives support to the integument which is immediately superimposed. (2) Fine protoplasmic strands passing inwards from the dermal portion. These by their anastomosis form a meshwork enclosing vacuoles in which various free cells lie. On reaching the ovaries they unite to form a delicate capsule, whence still finer strands pass to enclose the individual ova in follicle-like spaces.

Digestive Vacuole (Plate XXV. figs. 1, 2, 4).

Immediately over the mouth the ovaries are separated by a large vacuole extending between the dorsal and ventral layers of the dermal parenchyma and traversed by protoplasmic strands only at the periphery. The ovaries soon reunite ventrally, but the space is continued a short distance further along the mid-dorsum and roughly occupies the anterior middle fourth of the body. In it are found particles of ingested material together with wandering cells. It represents the digestive tract, but has not an epithelial lining or any defined passage to the mouth. The food-particles are in all probability caught in the mobile protoplasm presenting at the mouth, and passed on into this digestive vacuole.

Frontal Organ (Plate XXV. fig. 5).

The frontal organ differs from that of all other Acœla save *Böhmigia maris-albi* (Sabussow), and is here represented by numerous large single-cell mucous glands lying in the parenchymatous strands and bulging into the vacuolar spaces above and around the brain. Those lying immediately under the dermal parenchym dorsally are perhaps the largest, but their ducts all pass to open like those of the remainder, each by a separate aperture, on to the ventral surface only. As it perforates the cuticle each duct dilates to form a small ampulla. Both glands and ducts stain readily and deeply with hæmatoxylin owing to the presence of very fine granules. The secretion is adhesive and plays an important part in locomotion.

Nervous System.

The nervous system, which is not well differentiated, consists of two lateral masses situated at the anterior end of the body and communicating with one another by a commissure in which lies the otocyst. From each ganglionic mass a lateral and a posterior nerve are seen to be given off. The tissue generally is finely fibrillar, enclosing small clear cells with punctate nuclei. Eye-spots are absent.

Reproductive System (Plate XXV. figs. 6, 7).

A. incola is hermaphrodite and is found sexually mature at Millport, N.B., in June and July.

The penis is situated on the ventral surface at the junction of the posterior fourth with the rest of the body. It is conical and carries a knob-like armature at its distal end. At its proximal end its duct dilates to form a pyriform vesicula seminalis, the walls of which are formed by a thickening of the surrounding dermal parenchym and into which the testes open on either side by no distinct or epithelially lined channels. The testes consist of follicular masses extending forwards on either side in the parenchym of the lateral parts of the body, outside the ovaries, to beyond the mouth, and posteriorly also for a short distance into the tail. The sperm-follicles near the vesicula seminalis contain deeply staining chromatin figures.

The ovaries extend on either side of the middle line from beneath the brain to within a short distance of the male apparatus. They early unite, but are soon separated by the digestive vacuole, joining again in the posterior middle fourth of the body (figs. 1, 2). The ova increase in size as they pass backwards and are enclosed in delicate parenchyma, each occupying latterly a separate "follicle."

No accessory female organs are present. There is no vagina through which the ova can be extruded, and it would appear from a careful examination of ripe specimens that the cuticle simply gives way before the ripe ovum owing to an ever-increasing growth-pressure—this rupture taking place at a short distance in front of the penis (fig. 7). In several examples the ova lying most posteriorly had acquired a relatively dense capsule, stainable with osmic acid, and these not infrequently showed mitotic figures. These facts, taken in relation with the armature of the penis, seem to point to copulation being effected by simple perforation of the cuticle.

Systematic Position.

The turbellarian now described differs along with all the species of *Haplodiscus* from other Acœla in that it possesses no female accessoria. From *Haplodiscus* also it differs in the following respects:—

(1) Shape.
(2) Parasitic habitat.
(3) Mouth in anterior fourth.
(4) Paired lateral testes.
(5) No defined vasa deferentia.
(6) Penis with knob-like armature.
(7) Frontal organ well developed and opening by many mouths.
(8) Large digestive vacuole.

These differences seem to be of sufficient importance to warrant the erection of a new genus, which I have called *Avagina*. As an

indication of its habit—this being the first recorded parasitic Acœl (III.)—I suggested *incola* as the specific name.

NOTE ON THE PROPORIDÆ.

V. Graff in his recent monograph (I.) divided the Proporidæ—Acœla with one genital pore—into two genera: (a) *Proporus*, (b) *Monoporus*. In both these the male and female ducts open into a common atrium genitale which communicates with the exterior by a single aperture. They are distinguished from each other by the absence and presence respectively of a spermotheca.

Since then (1890) some further contributions have been made to our knowledge of this family. In 1892 v. Graff (II.) drew attention to the turbellarian characters of *Haplodiscus piger* (Weldon). In 1895 Böhmig (IV.) described six new species of this genus and corroborated Weldon's observation of the absence of female accessoria. The following year Sabussow (V.) recorded another species, on which also Monticelli wrote (VI.). In 1899 Sabussow (V.) obtained from the White Sea an Acœl to which he gave the name *Böhmigia maris-albi* (VII.).

Böhmig's classification of the family is as follows:—

"Genera—(a) *Monoporus*—Proporidæ mit Bursa-seminalis, &c.
(b) *Proporus*—Proporidæ ohne Bursa-seminalis, &c.
(c) *Haplodiscus*—Proporidæ ohne Bursa-seminalis. Die Mundöffnung findet sich in oder hinter der mitte der Bauchflache. Der Pharynx ist, wenn vorhanden, kurz und wenig entwickelt. Der Korperform ist platt scheibenformig."

He thus distinguishes *Proporus* and *Haplodiscus* merely by the position of the mouth, the size of pharynx, and shape of body, while he ignores the absence in *Haplodiscus* of the "atrium genitale" in the other two genera.

Now it has been shown above (p. 409) that in *Avagina* the female apparatus is incomplete, the ova being extruded through a temporary opening which has no connection with that of the male organ. As in *Haplodiscus* there is a similar absence of vagina, it seems not improbable that a like method of ova-extrusion also obtains.

The union of the male and female systems to form a common genital atrium in the genera *Proporus*, *Monoporus* and *Böhmigia*, and their total separation in *Haplodiscus* and *Avagina*, seem to render desirable a subdivision of the family as under:—

Family PROPORIDÆ: Acœla with one genital aperture.
Subfamilies I. *Proporinæ*: to include those Proporidæ with a common genital atrium.
Genera: (a) *Proporus*, (b) *Monoporus*, (c) *Böhmigia*.
II. *Avagininæ*: to comprise those Proporidæ with male accessoria only.
Genera: (a) *Haplodiscus*, (b) *Avagina*.

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HYBRID GROUSE

(LAGOPUS LAGOPUS ♂ × LYRURUS TETRIX ♀)

In conclusion, I have to acknowledge my indebtedness to Dr. J. F. Gemmill for the privilege of working up my material in his Laboratory at Glasgow University. To Dr. Teacher, of the Hunterian Museum, also I owe and now tender my best thanks.

Papers referred to.

(I.) v. GRAFF.—Die Organisation der Turbellaria Acœla. 1890.
(II.) v. GRAFF.—Zoologischer Anzeiger, 1892.
(III.) v. GRAFF.—Die Turbellarien als Parasiten und Wirte. 1903.
(IV.) BÖHMIG.—Die Turbellaria Acœla der Plankton-Expedition. 1895.
(V.) SABUSSOW.—"*Haplodiscus ussowi*, n. sp." Mitth. zool. Stat. Neapel. 1896.
(VI.) MONTICELLI.—"A proposito del *Haplodiscus ussowi*." Atti Soc. Natur. Modena, (4) vol. 1.
(VII.) SABUSSOW.—"*Böhmigia maris-albi*, g. et sp. n." Zool. Anzeig. xxii. p. 89.

EXPLANATION OF PLATE XXV.

All the figures except fig. 1, which is diagrammatic, were drawn from photomicrographs of sections.

List of Reference Letters.

Br. Brain. *c.* Cuticle. *d.p.* Dermal layer of the parenchyma. *d.v.* Digestive vacuole. *F.d.* Frontal ducts. *F.g.* Frontal glands. *F.o.* Orifices of frontal ducts. *m.* Mouth. *mus.* Muscular layer. *ot.* Otocyst. *ov.* Ovary. *p.* Penis. *p.a.* Armature of penis. *p.s.* Parenchymatous strands. *s.* Cilia. *t.* Testis. *vag.* Adventitious "vagina." *v.s.* Vesicula seminalis.

Fig. 1. The general topography of *Avagina incola* shown diagrammatically. × 20.
2. Median longitudinal section. × 20.
3. Integument and dermal parenchyma. A × 600. B × 700.
4. Mesial longitudinal section showing "digestive vacuole." × 75.
5. Longitudinal section of anterior end showing frontal glands. × 150.
6. Longitudinal section through male apparatus. × 150.
7. Longitudinal section of posterior extremity showing adventitious opening by which ova are being extruded. × 45.

3. On Two Specimens of "Riporre" with known Parentage. By Dr. EINAR LÖNNBERG, C.M.Z.S., &c.

[Received February 6, 1904.]

(Plate XXVI.)*

When the author of these lines last summer visited the town of Piteå, in Northern Sweden, he had the opportunity of seeing two fine specimens of Riporre, then in the possession of Dr. T. H. Björkbom†. The great interest connected with these two specimens is that their parentage is fully known. They are from

* For explanation of the Plate, see p. 415.
† They are now in the zoological collections of the Gothenburg Museum.

a small peasant village, Rasvik, situated in the country parish of Piteå, Government district of Norrbotten, thus not far from the town mentioned. The *mother bird* of these Riporre specimens was, *undoubtedly, a hen of Lyrurus tetrix.* She had laid and afterwards hatched her eggs near a peasant's house in a small hamlet, consequently the hen and her six chickens were observed almost every day during the summer and autumn of 1901. As soon as the birds got scared they perched in trees as the Black Game does, *unlike the Willow-Grouse.* When full-grown they were shot, all of them the same autumn. The first four were sold to an innkeeper in the town of Luteå, who, not recognising their hybrid nature, had them plucked and eaten. The last two, however, luckily fell into the hands of Dr. Björkbom, who took care of them and had them mounted. Both these specimens are males shot in the month of October, the one a little earlier than the other, so that it was still in moult and retained some of the feathers of the autumn plumage. These feathers are situated in such a manner that they form a patch behind the eye and on the sides of the occiput, and a broad band on the sides of the lower neck, extending with some scattered feathers on the fore-neck, and are almost exactly like those in the corresponding situation of a young Blackcock just moulting to assume its first black plumage. They are thus barred with light buff and brownish black, the bars being, however, at least partly, a little narrower in the Riporre than in the young Blackcock. There is thus no trace of the rufous of the Willow-Grouse in these feathers. A few scattered scapulars, which are mixed buff and black, have an appearance which may be termed intermediate between that of the corresponding ones of *Lyrurus tetrix* ♀ and that of *Lagopus lagopus* ♀, and differs from that of the males of both species. With regard to the pattern, the axillaries of this Riporre specimen approach perhaps more those of the female Willow-Grouse than those of the Grey-hen. With the exception of these feathers, almost every feather of the whole plumage of both Riporre specimens is either more or less white, or is, with slight modifications, like that of an immature Blackcock. The description of the Riporre cock in winter plumage which Collett has given * is quite correct for these specimens too, and need not be repeated.

An analysis of the plumage, however, may not be without interest. The white must, of course, be regarded as an inheritance from the Willow-Grouse father, except in such places where the Blackcock as well is normally white, as on the under tail-coverts, on the wing, &c. The whole upper surface of the Riporre is, with only slight modification, derived from the Blackcock, and this modification consists only in the fact that the fine brown sprinklings and vermiculations on the feathers of the Blackcock (immature or in summer plumage) in the Riporre are

* Proc. Zool. Soc. 1886, p. 224.

represented by white ones of the same kind, which become more conspicuous through contrast with the black than the brown is in the Blackcock. On the rump of the Riporre, however, the brown of the feathers is substituted by white only at their edges, while otherwise the fine wavy brownish lines remain. The upper tail-coverts are black but have broad white edges, and so have, although to a less extent, the middle rectrices. In the latter the white edges are exaggerations of the conditions found in the immature Blackcock; in the former the white edges correspond to the freckled edges of the same feathers in the Blackcock. The tail of the Riporre is deeply cleft, so that the middle rectrices are 2½–3½ cm. shorter than the outer. The wing-coverts look almost all white, but a closer examination reveals that their basal hidden parts are black, or at least densely sprinkled with blackish. The white in these feathers has a distribution which corresponds to the area of the same feathers of the Blackcock, which is freckled with buff. The ends of the secondaries of the Rippore are more broadly tipped with white than in the Blackcock. But otherwise these parts are blackish, richly mottled with white all over their middle and basal portion. This is the more peculiar, as these parts of the secondaries are pure white in the Blackcock as well as in the Willow-Grouse. Here is thus a characteristic which is not inherited from either of the parents as it appears at first, but it is nevertheless a tetricid characteristic. The secondaries of the Blackcock are, between the white basal half and the terminal narrow white edge, blackish, more or less mottled with buff. This area has, in the Riporre, expanded over the greater basal part of the feathers at the same time as the mottling became white instead of buff. In such a way the Riporre lost the, for the Blackcock, characteristic broad white band across the wing, while the narrow terminal band became broadened. The outer web of the primaries, which in the Blackcock is pale brownish with whitish mottling, has in the Riporre become wholly white, and the inner web has in the latter become mottled with white and quite white at the tips, where the Blackcock shows a mottled area.

A broad band through the eye of the Riporre is white. In the same place the immature Blackcock, or that in summer plumage, is mottled with white. Below this space the Riporre has a black band in which the feathers are very feebly edged with white. The same area is in the Blackcock glossy bluish black, but immature males often show the same whitish edging, although still less developed. The fore-neck and the sides of the neck, as well as the chest and belly, of the Riporre are white, although the invisible basal parts of the feathers are more or less black. The upper part of the breast is black, but mixed with broadly white-edged feathers. The feathers of the flanks are black, with broad edges or outer halves white, whereby a spotted appearance is produced. The lower parts have thus received more white from the Willow-Grouse than the upper parts have.

The Blackcock inheritance, however, is conspicuous in the black feathers or black bases of white feathers. From this analysis it is apparent that the Riporre in winter plumage is unable to produce the buff pigment which is found in the immature Blackcock, so that therefore this coloration is substituted by white, often in an exaggerated way. It is also obvious that areas that in the Blackcock are mottled have a greater tendency to become white in the Riporre than spotted black. The feathers of the Blackcock which are more or less pale-edged become in the Riporre more broadly white-edged or retain only a black base. In the areas in the Blackcock which are quite black or glossy black, the same coloration is most dominant in the Riporre as well.

The tarsi and toes of these specimens are white with long feathers, especially in the specimen which has assumed full winter garb. The claws are very large and coloured as in the Willow-Grouse, that is, paler than in the Blackcock. The length of the middle claw is in one specimen 22 mm.; in the other, which was shot earlier, 20 mm. The claws are, however, compared with their length not so broad as in the Willow-Grouse, and distinctly oblique as in the Blackcock. From the latter is also inherited the toothed comb underneath the toes. The feet are thus quite intermediate in structure.

The lengths of the wings are respectively 234 and 237 mm. This measurement thus agrees with the smaller and medium-sized specimens which Collett has measured.

A third male specimen of Riporre kept in the Upsala Museum, and obtained from the province of Vesterbotten, is a good deal darker than those just described. But its coloration adheres to the same systematic pattern. The neck, except in front, is quite black, with narrow white edges to the feathers. The fore-neck looks white, but the concealed parts of the feathers are black. The upper breast is wholly glossy black*. The metallic lustre is not, however, blue as in the Blackcock, but rather purple as in the Rachelhane (hybrid between Capercaillie ♀ and Blackcock); and this is of interest, because it indicates that the structure of the glossy feathers of the Blackcock seems to be influenced in a similar way through hybridisation with Willow-Grouse as with Capercaillie†. The flanks, wing-coverts, wings, &c. are also darker in this specimen, the front of the tarsi is mixed with grey, and the claws are darker than in the specimens described above. But in spite of this the general arrangement of the coloration is the same, and this seems to indicate that there is only *one kind of Riporre-hybrids* produced in the same way by a Grey-hen mated with a male

* It is probable that this specimen is older than the others. It is in very fine plumage, and somewhat larger in size, the wing measuring 245 mm.

† The purple lustre of the Rachelhane cannot therefore be interpreted as having originated by a mixing of the structures causing the green lustre in the Capercaillie and those causing the blue in the Blackcock.

Willow-Grouse, and that in these hybrids the tetricid inheritance from the mother dominates, and probably becomes more so with age.

A similar conclusion is deduced from a study of the female Rippore specimens. The darkest specimen in Upsala looks almost like a small Grey-hen * which has got white or white-freckled edges to her feathers. The proximal secondaries are, however, like those of the male Riporre just described, and the distal ones are wholly white. Another difference is that the outer tail-feathers are black. Towards the centre of the tail the rectrices become more and more transversely (corresponding to the rufous bars of the Grey-hen) mottled, first on the outer web, then right across with whitish, then buff and rufous-buff, so that the central tail-feathers are almost like those of a Grey-hen, although the rufous bars are somewhat broken. The white tips, absent in the outer tail-feathers, become larger towards the centre. The outer tail-feathers are thus more like those of a Willow-Grouse; the central ones more like those of a Grey-hen. In addition to the white edges, the feathers of the back show another difference from those of the Grey-hen; they have, as a rule, only one or two rufous bars, the proximal of which is more or less broken, while the Grey-hen has three or more. This difference in the Riporre is not, however, a characteristic in which it approaches the Willow-Grouse, which has numerous narrow wavy bars. The front of the tarsi is grey but long-feathered. The claws are rather dark. The lightest of the female Riporre specimens in Upsala has broader white-freckled edges to the feathers on the back, but otherwise the same feathers are almost similar to those of a Grey-hen with three complete bars of buff. Wing and tail of this specimen are a little more freckled than in the other. The one has the abdomen white, and is a young bird, while the darker is old. We have here, consequently, a condition parallel to that above-stated for the cocks, viz., the female Riporre becomes darker with age, and resembles more a Grey-hen, and there is only *one kind of Riporre*, the origin of which must be as stated above.

EXPLANATION OF PLATE XXVI.

Hybrid Grouse, *Lagopus lagopus* ♂ × *Lyrurus tetrix* ♀.

* The feathered toes, &c., prove the hybrid nature.

March 15, 1904.

Dr. HENRY WOODWARD, F.R.S., Vice-President, in the Chair.

The Secretary read the following report on the additions that had been made to the Society's Menagerie in February 1904:—

The registered additions to the Society's Menagerie during the month of February were 68 in number. Of these 31 were acquired by presentation and 12 by purchase, 19 were received on deposit and 6 by exchange. The total number of departures during the same period, by death and removals, was 89.

Among the additions special attention may be called to:—

1. Two Asiatic Wapiti, presented by the President on Feb. 23, probably representing a distinct subspecies.

2. A stallion Kiang (*Equus hemionus*), obtained by purchase on Feb. 26.

Mr. Frank Slade, F.Z.S., exhibited and made remarks upon a living Bantam hen which had on each of her wings a well-developed thumb and claw.

Dr. C. I. Forsyth Major, F.Z.S., exhibited some dental peculiarities in a Rodent (*Hystrix leucura* Sykes), a Springbok Antelope (*Antidorcas euchore* (Zimm.)), and a Tertiary Shrew ("*Sorex pusillus* H. v. Mey., var. *grivensis* Dep."), and made the following remarks:—The specimens exhibited have in common the peculiarity of possessing additions to what is or is believed to be the normal number of teeth in their respective groups; otherwise, however, these peculiarities belong to very different categories. The specimens are:—

I. *Cranium of an Indian Porcupine*, Hystrix leucura *Sykes*, ♀ (text-fig. 79, p. 417), *showing in the maxillary five cheek-teeth, four being the usual number.*

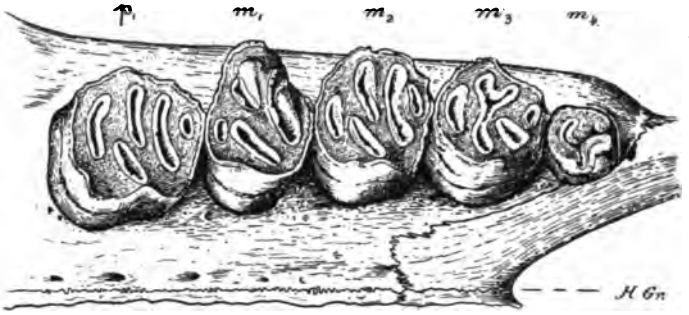
The skull, which is of unusually large size (basal length = 143·5 millim.), was placed in my hands by Prof. G. B. Howes, to whom it had been presented by Captain Stewart R. Douglas. The locality given is Datta Khel, Tochi Valley, Bunnu District, Punjab.

Variations in the number of teeth are exceedingly rare in Rodentia, if we except one family, the Bathyergidæ. Almost the only case recorded in literature of a supernumerary tooth in another family is the one mentioned by Charles Darwin, in the skull of the lop-eared variety of the domestic rabbit; in that case "there was an additional molar tooth on each side of the upper jaw, between the molars and premolars; but these two teeth did not correspond in size."*

* Charles Darwin, "The Variation of Animals and Plants under Domestication," 2nd ed. vol. i. p. 125 (1875).—Only one similar case amongst Leporidæ has since been recorded, curiously enough in the very same variety of the domestic rabbit; the supernumerary tooth was, however, present on one side only (H. v. Nathusius,

In all the genera of Hystricidæ we have normally four cheek-teeth above and below on either side of the jaw, making sixteen in all. Of these, the three posterior are true molars; the anterior

Text-fig. 79.



Hystrix leucura, left maxillary. Double nat. size.

one of each row is, in *Hystrix*, a premolar, having replaced a deciduous tooth. The four teeth of the species of *Hystrix* are

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Über die sogenannten Leporiden, p. 15, 1876).—An adult rabbit's skull, now before me, containing *two* left posterior incisors, situated side by side, was exhibited some years ago at a meeting of this Society by Mr. Holding.—Complete absence of the small posterior incisors, without any trace suggesting that they had ever been present, was met with by H. v. Nathusius in the skull of a so-called "Leporide," forwarded to him as the presumed descendant of a cross-breed between the Rabbit and the Common Hare. The same writer records a communication to him from Hensel, who had found that these posterior incisors were absent in several skulls of the common domestic rabbit (Der Zoologische Garten, xx. p. 134, footnote (1879)).—The last upper molar in Leporidæ, being much reduced, might be expected to be frequently missing; it is, however, remarkably constant. G. R. Waterhouse mentions a case in a "*Lepus mediterraneus*" where this sixth upper molar was absent on either side ('A Natural History of the Mammalia,' ii. p. 44 (1848)). Although it has been repeatedly asserted (Ann. Mag. Nat. Hist. (3) xx. p. 222 [1867]; (7) i. p. 157 [1898]) that Waterhouse was mistaken in making this statement, he was perfectly right; the skull in question, from the Island of Kerkenna, off Tunis, is in the British Museum (Zool. Dep.), No. 46.10.30.162. ♀. At my request, Mr. O. Thomas was good enough to have the skull taken out of a second hare's skin from Kerkenna, No. 46. 10.30.161, and in this also the last upper molar is absent on both sides; in the case of the Kerkenna Hare it seems therefore that we have to do with something more than a mere individual variation. It would be interesting to ascertain whether this character is *constant* in the Kerkenna Hare, which differs besides from the one on the neighbouring continent (*Lepus tunetæ* de Wint.), with which it was united by previous writers, in the much larger size of the cheek-teeth and incisors, as well as in other characters.—The only other specimen of a *Lepus* in the Natural History Museum showing the anomaly referred to, is a skull of a ♂ of *Lepus europæus occidentalis*, from Merton Hall, Norfolk (No. 98.2.11.1); on the left side the last upper molar is present, but there is no trace of either the tooth or its alveolus on the right side.—In *Caprolagus hispidus* (Pears.), the Assam Hispid Hare, the last molar is more reduced in size than in any other member of the Leporidæ; but is missing in none of the five skulls of the species in the Natural History Museum. A second species of *Caprolagus*, *C. furnessi* Stone, obtained on the Liu Kiu Islands, was described not long ago; in the only skull examined there was "no trace whatever of the small posterior upper molar" (Proc. Ac. Nat. Sci. Philad., 1900, p. 461).

approximately of the same size; the premolar, however, is slightly larger; a further feature being that, having come in place after m. 1 and m. 2, it is less worn than these two.

By the criteria just mentioned, it is possible to determine the anterior tooth in our specimen as the unique premolar, the three teeth following as the three true molars. So that it is the fifth tooth, the last in the series, which is supernumerary. It is distinguished from all the others by its much smaller size, and by reproducing only part of the pattern common to the anterior teeth. Length of the four anterior molars = 35 millim., length of the supernumerary = 4 millim.

We have been told more than once that there are no individual homologies in Mammalian teeth; the reason, which apparently is considered as the most weighty, being that "on the analogy of what may be seen in the case of Meristic Series having a wholly indefinite number of members, it is likely that the attempt thus to attribute individuality to members of series having normally a definite number of members should not be made." *

The "*definite* number" is just what makes all the difference; now that order, differentiation, division of labour have been established, as the gradual outcome of what before had been chaos, at least for our short-sighted eyes, we can begin to speak of *individual* homologies, while before we could speak only of *collective* homologies. And it is precisely the variations that help us towards making out the individual homologies: witness E. Rosenberg's researches on the variations occurring among the permanent incisors of man †.

The old truth that there is a common bond between all the teeth of one specimen, does not invalidate their individuality. They are all brothers, being children of one mother, the dental lamina; some slight peculiarity in the enamel pattern, by which different species may be distinguished from each other, is often enough common to all or to several of the cheek-teeth of one specimen. In this connection an interesting fact, pointed out by Bateson, is worth mentioning. When a supernumerary tooth is added to the posterior end of the series, the normally ultimate tooth, which has become the penultimate, is not unfrequently abnormally enlarged. This circumstance is considered by the writer to favour his view of the non-existence of individuality, for "the new member of the series seems, as it were, to have been reckoned for before the division of the series into parts." ‡ To me the obvious explanation appears to be, that by the increased activity of the dental lamina, which not unfrequently takes place at the end of the teeth-series, and results in the production of a supernumerary tooth, the normally last tooth has profited as well; so that, as in so many other cases, the variation, the exception, confirms the rule.

* W. Bateson, 'Materials for the Study of Variation,' p. 273 (1894).
† Morph. Jahrb. vol. xxii. pp. 264–338 (1895).
‡ Proc. Zool. Soc. London, 1892, p. 111.

There are, of course, cases where we are at a loss to give the proper explanation of a numerical variation—to state, that is, which of the teeth is the supernumerary; but that depends often on particular circumstances inherent to the species, as in the case of an *Ateles marginatus* in the Natural History Museum (No. 1214 B), on which great stress has been laid. This specimen has four premolars in each upper jaw instead of three. "There is nothing in this specimen to indicate that any of these teeth should be considered supernumerary more than any other; and in the absence of such evidence it would, as I think, be best to regard the four premolars in this specimen as collectively representing the three premolars of the normal. For just as a stick may be broken into three pieces or into four, so would it seem to be with Multiple Parts."*

The simile would be appropriate if *Ateles marginatus*, or the other species of the genus, presented us with numerous instances of four premolars; but among hundreds of examined specimens this is the only one in which the "stick" has been broken into four "pieces." The reason why we cannot in this instance state which of the four teeth is the supernumerary, depends on the exceeding likeness in size and shape between the upper premolars of *Ateles*. If instead of being acquainted with only one stage in the life-history of this specimen, we had been able to watch it from its childhood and follow the gradual development and coming in place of the premolars, we would presumably not have been left in the dark as to the individualities of the premolars in question.

II. *Two fœtal skulls of the Springbok* (Antidorcas euchore *Zimm.*), *one undoubtedly female* (text-fig. 80, p. 420), *the other probably male* (text-fig. 81); *both exhibiting calcified upper canines.*

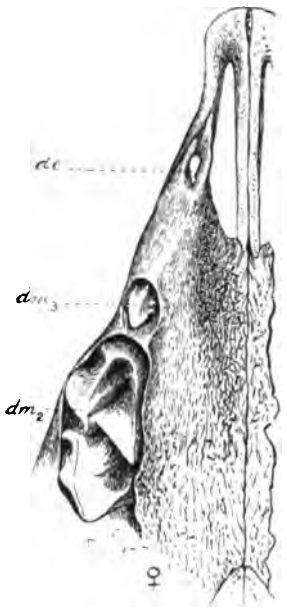
The dry skulls were kindly forwarded to me by our corresponding member, Dr. R. Broom, of Pearston, South Africa, who previously wrote to me that he had found small canines in male (?) and female Springboks before birth, adding that he thought they never cut the gum.

The female skull, which appears to be slightly younger than the other, has a basal length of 47 millim.; the second deciduous molar is about to cut the gum, the first and third being slightly more retarded. The antero-inferior tapering termination of the maxillary presents on either side a shallow furrow, in which is imbedded a diminutive somewhat club-shaped tooth, in a procumbent position, parallel to the long axis of the skull. The anterior portion of the tooth, which is scarcely over 1 millim. long, is thicker than the posterior; the latter shows an open root, so that the tooth may not have attained its full length. In the second skull, which, according to what Dr. Broom informs me, is presumably that of a male, the shape of the teeth is the same as in the

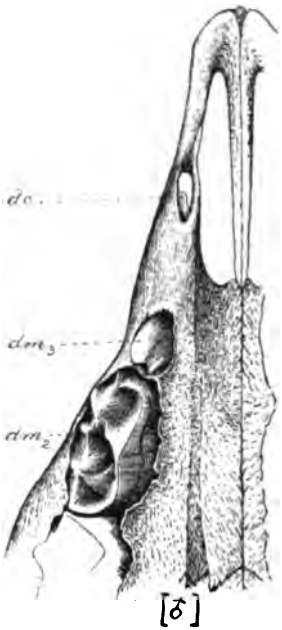
* Bateson, *op. cit.* pp. 113, 114.

female skull and their length is 2·5 millim. Basal length of the skull = 48 millim. The two posterior deciduous cheek-teeth appear to have just cut the gum; the anterior of the two (dm 2) is slightly in advance of the posterior.

Text-fig. 80.



Text-fig. 81.



Text-fig. 80.—*Antidorcas euchore*, ♀, right maxillary. Double nat. size.
Text-fig. 81.—*Antidorcas euchore* (♂?), right maxillary. Double nat. size.

Deciduous upper canines have not been often recorded in Antelopes; I can find only five writers who make mention of them.

In this Society's 'Proceedings' for 1878, Sir V. Brooke gave, side by side, in tabular form the characters which distinguish the Cervidæ from the Bovidæ. Under No. 6 he states:—

"*Cervidæ*.	*Bovidæ*.
Upper canines present in both sexes. Exceptions	Canines absent in both sexes. Exception, *Nanotragus pygmæus* [= *Neotragus pygmæus*] has sometimes the upper milk-canine." *

The writer was not aware that in 1836 Rüppell had already

* Proc. Zool. Soc. London, 1878, p. 884.

described upper canines, which do not cut the gum, in the young males of the Abyssinian Antelope, *Ourebia montana* (Rüpp.). Rüppell stated expressly that the young females are destitute of them *.

In a very young Saiga Antelope, A. Nehring describes and figures a left-side canine lying in a shallow furrow of the maxillary. It is supposed that somewhat later the maxillary would have formed a regular alveolus; this is, however, unlikely. On the right side there was equally a shallow furrow, but the tooth was wanting †.

H. Nitsche describes in the macerated skull of a few months' old female Chamois (*Rupicapra rupicapra*) a distinct alveolus, 8 millim. long, of the upper canine which apparently had not cut the gum. The tooth had been lost during maceration ‡.

A. Nehring mentions in the skull of a young Indian Antelope, *Antilope cervicapra*, "two well-developed canines in the maxillary" §. No other particulars are given.

Two skulls of a few days' old specimen of an Antelope from Obock, unknown to the writer, M. Heude, showed each a pair of small procumbent canines directed forwards. The skull of a half-adult specimen had preserved the canine, enclosed in the borders of the maxillary ("encastrée dans les bords maxillaires") ||.

The same observer mentions that one of four skulls of *Neotragus*, age not stated, showed the two canines broken at their "collet" ¶.

I append the result of a very cursory review of the Antelope-skulls in the Natural History Museum, made with the intelligent help of Mr. O. Thomas's young assistant, Mr. E. C. Chubb:—

(1) Dry skull of *Madoqua philippsi* Thos. (No. 99.12.28.4). No sex stated. Very young specimen; the three deciduous molars and m. 1 are *in situ*, all four scarcely worn. On the left side of the maxillary is present a somewhat laterally compressed upper canine, which certainly had not cut the gum. The right-side alveolus is empty.

(2) Dry skull of half-adult ♀ of *Madoqua kirkii* (Günth.), No. 1720 B (79.12.18.1), one of the types of Günther's *Neotragus kirkii*, from South Somali. The much-worn deciduous molars are in place, as well as the two anterior true molars. The partly obliterated alveoli of the upper canines are visible on the anterior tapering terminations of the maxillary.

(3) Dry skull of young *Neotragus pygmæus* ("*Nanotragus perpusillus*") from Fantee, No. 73.6.22.11. Deciduous molars and m. 1 in place. The upper canines are present; they are placed almost vertically in the jaw and, being worn, had no doubt functioned.

(4) Young ♀ of *Gazella picticauda* (Hodgs.), the Himalayan

* P. Z. S. London, part iv. 1836, pp. 3, 4.
† Sitzgsber. Ges. nat. Fr. Berlin, 20 Febr. 1883, p. 13.
‡ Tharander forstl. Jahrb. 1883, 2. p. 23 (of separate), footnote.
§ *Op. cit.* 21 Oct. 1884, p. 136.
|| Mémoires conc. l'Hist. Nat. de l'Empire Chinois, ii. 4. p. 191, ftn. 2 (1894).
¶ *Id. ib.*

Goa. Dry skull, No. 56.10.1.2. The deciduous molars still in place; m. 3 had not yet cut the gum. Horizontally directed alveoli of the lost upper canines are to be seen in the usual place.

From this survey of what is at present known about these rudimentary canines, it would appear that, with the exception of *Neotragus* (*pygmæus*), they never cut the gum, and are usually dropped very early in life, so that in the great majority of cases they are perfectly functionless. Although so few cases have been recorded, they represent the principal groups of Antelopes; and I feel sure that calcified rudimentary milk-canines will be found to be normally present in all fœtal and most very young Antelopes, and that it is only owing to the great scarcity of fœtal and very young skulls in our Museums that they have not been observed more frequently.

In the earliest known undoubted Antelopes, from the Middle Miocene, the anterior portion of the maxillary is never preserved. In the same deposits occur detached upper canines of Ruminants. These become much more numerous in the Oligocene, where they are besides not unfrequently met with in place in more or less complete skulls; and it has always been assumed as a matter of course that all these remains are those of either Cervidæ or Tragulidæ. Since, however, we may conclude, from the vanishing rudiments present in recent Antelopes, that the early representatives of the family were provided with functional upper canines, the presence of the latter in remains of Tertiary Ruminants can certainly no longer be considered in itself as a reason for excluding the Antelopes. The Oligocene *Gelocus*, e. g., has been repeatedly associated with the Tragulidæ; but it might more appropriately been termed an ancestral Antelope.

The "Anlagen" of the upper canine and the lateral (third) incisor have been demonstrated and carefully studied in early fœtal stages of the domestic sheep and oxen (Goodsir, Piana, Pouchet et Chabry, Mayo, A. Hoffmann, Röse und Bartels, and others); but I do not know that calcified upper canines have ever been observed in either Ovines or Bovines; neither is there a trace of their alveoli in a fœtal Giraffe in the Natural History Museum.

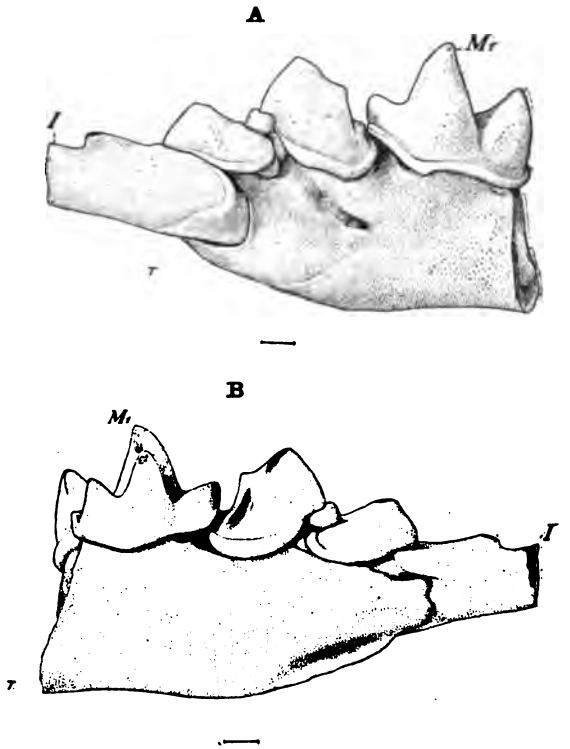
III. *Additional minute cheek-tooth in the mandible of a Tertiary Shrew*, "Sorex pusillus *H. v. Mey.*, *var.* grivensis *Dep.*" (text-fig. 82 A, B, p. 423).

In the Shrew family (Soricidæ) the number of the upper teeth varies considerably according to the different genera and even species; it is, however, remarkably constant in the lower jaw of recent Shrews, in which, with one exception pointed out by Dobson (*Myosorex varius* Gray), there are invariably *six* teeth, viz. three true molars, and two minute teeth, situated between the anterior true molar and the large anterior procumbent incisor.

W. B. Scott has described a Shrew (*Protosorex crassus* Scott

from the Oligocene White River Beds of North America*, in which there are four minute teeth between the molars and the large incisor, making *eight* mandibular teeth. It was therefore to be foreseen that in later Tertiary deposits would be found Soricidæ with the number of lower teeth intermediate between the number occurring in the Oligocene and that in the recent Shrews, viz. *seven*. In fact, I find that in the "*Sorex pusillus* H. v. Mey.,

Text-fig. 82.



"*Sorex pusillus*, var. *grivensis*," anterior portion of left mandibular ramus: **A**, outer; **B**, inner aspect.

var. *grivensis* Dep.," which is not unfrequent in the Middle Miocene of La Grive-Saint-Alban (Isère), a diminutive tooth was present between the two minute intermediate teeth; it has in most specimens dropped out, but its alveolus is invariably present. The specimen figured is a fragment of the left mandible containing five teeth, viz., from fore to back, the procumbent incisor (the

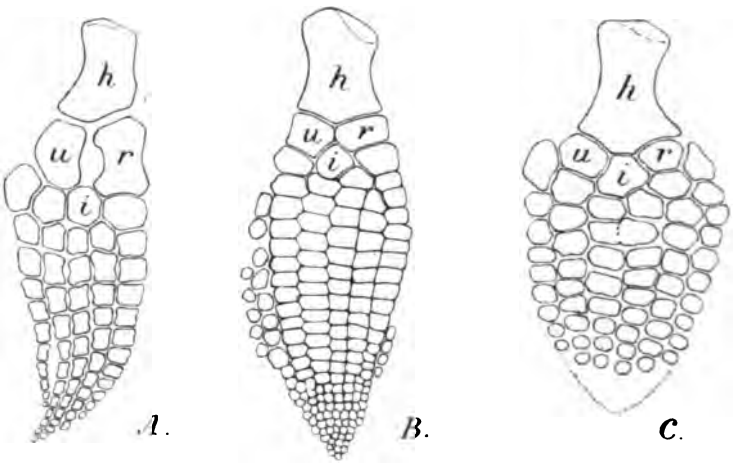
* Proc. Ac. Nat. Sci. Philad. 1894, pp. 446–448 (1895).

anterior portion of which is broken away), the two intermediate teeth, with between them the diminutive tooth which had up to now escaped the describers of "*Sorex pusillus*," and the anterior true molar.

The diminutive tooth in question is slightly larger than the additional tooth occupying the same position in the recent *Myosorex varius*. So long as more fossil forms are unknown, the homologies of these intermediate teeth will remain doubtful; the diminutive one is presumably the homologue of the tooth which M. F. Woodward found as a vanishing structure in an embryo of *Sorex* (sp. ?), and which he considered to be the third lower permanent incisor *.

Mr. G. A. Boulenger, F.R.S., exhibited a remarkable Ichthyosaurian right anterior paddle (text-fig. 83) from the neighbourhood of Bath, which he had received from Mr. H. E. Lansdown, of Bath. The locality and horizon of the specimen, which had been in the possession of the late Miss Mary Ashley, were unknown.

Text-fig. 83.



Right anterior limb of *A. Mixosaurus cornalianus* (after Repossi); *B. Ichthyosaurus communis* (after Lydekker); *C. Ichthyosaurus extremus*.

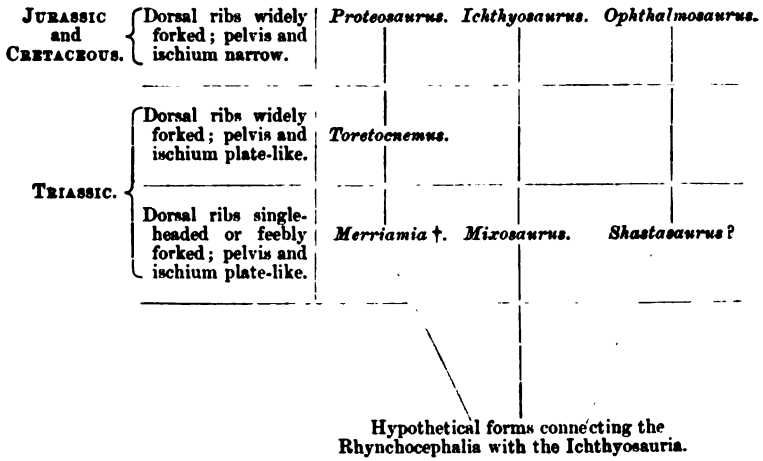
In having three facets to the distal extremity, the humerus of this specimen, had it been found isolated, would have suggested *Ophthalmosaurus* (from which *Baptanodon* can hardly be separated on the evidence available at present); but, as shown by Seeley, the three facets of the *Ophthalmosaurus* humerus are for articulation with the radius, the ulna, and an ulnar sesamoid bone

* Proc. Zool. Soc. London, 1896, p. 569.

(pisiform), whilst in the present case the additional facet received the intermedium, which penetrates between the much reduced epipodials, as is known to sometimes happen in the hind limb of *Ichthyosaurus communis* and *I. quadriscissus*. Besides, the compact arrangement of the phalanges shows a nearer relation to *Ichthyosaurus* than to *Ophthalmosaurus*. In fact this paddle appears to represent the extreme of the latipinnate group for which the generic name *Ichthyosaurus, sensu stricto*, is to be retained, and is characterised by the development of both radial and ulnar sesamoid bones.

Mr. Boulenger pointed out that an evolutionary series could be traced between the most generalised and geologically oldest of Ichthyosaurs, the Triassic *Mixosaurus*, through the latipinnate *Ichthyosaurus* (e. g. *I. communis*) to the type here described and for which the name *Ichthyosaurus extremus* * (*cf.* Abstr. P. Z. S. 1904, No. 5, p. 18, March 22) was proposed. Whilst the forms in which a single row of carpals and of phalanges correspond to the intermedium, instead of two (*Leptochirus* = *Merriamia*, *Toretocnemus*, longipinnate *Ichthyosaurus* = *Proteosaurus* Home), represent a distinct series, likewise extending from the Upper Trias (California) to the Upper Jurassic (Solenhofen).

Ophthalmosaurus may be regarded as probably the terminal form of a third series, as shown in the following diagram. The paddles of *Shastasaurus*, from the Upper Trias of California, are yet imperfectly known, but the genus is provisionally placed by O. P. Hay in the Baptanodontidæ.



* [The complete account of the new species described in this communication appears here; but as the name and preliminary diagnosis were published in the 'Abstract,' the new species is distinguished by being underlined.—Editor.]

† The name *Leptochirus* J. C. Merriam, 1903, being preoccupied, that of *Merriamia* is here proposed to replace it.

The paddle exhibited measures 370 millimetres; a small piece of the proximal extremity of the humerus is broken off, and a few of the distal phalangeals appear to be missing.

The specimen has been presented by Mr. Lansdown to the British Museum.

P.S.—Mr. Horace B. Woodward, F.R.S., has kindly examined the matrix of the specimen, which called to his mind that of some layers of the Lower Lias of Weston near Bath, and on comparing it with samples collected at that locality he found it to agree as closely as possible. The beds are noted in the Memoir on Jurassic Rocks of Britain, vol. iii. p. 134.—G. A. B., 19.3.04.

Mr. A. E. Pratt exhibited a series of skins of Paradise-birds which he had recently collected in the Owen Stanley range, British New Guinea; also a series of photographs taken by his son during a two years' residence amongst the natives near the frontier of German New Guinea.

The following papers were read:—

1. Note on the Skull and Markings of the Quagga

By R. Lydekker.

[Received February 27, 1904.]

(Text-figures 84–86.)

Readers of the late Sir William Flower's excellent little volume on 'The Horse' will not fail to remember how assiduously the author endeavoured to bring into prominence all evidence of the ancestral history of the family displayed by its existing members. I shall therefore be only emphasising Sir William's own line of investigation if I direct attention to an oversight in regard to one particular vestigial feature met with in certain living members of the *Equidæ*.

On page 64 of the work in question, which was published in 1891, will be found a statement to the effect that although the skulls of *Hipparion* and certain other extinct representatives of the family display a preorbital depression for a face-gland comparable to the larmier of the Deer, yet that no traces of such a pit are to be found in any of the existing species of the family. From this presumed absence of any trace of the face-gland of *Hipparion* in existing forms of *Equus*, it has been urged that the latter genus cannot be the lineal descendant of the former.

The fact that the late Professor Huxley* in 1870 indicated the existence of a rudimentary preorbital pit in the skull of *Equus sivalensis* might have been cited in disproof of the inference

* Quart. Journ. Geol. Soc. vol. xxvi. Proceedings, p. 1.

in question. Nor is this all, for so long ago as 1880 Dr. Forsyth Major* had actually pointed out the existence of a similar feature in two living species of the family, in addition to noticing its occurrence in the fossil *Equus stenonis* of the Pliocene beds of the Val d'Arno, and its somewhat later ally *E. quaggoides*.

In this connection I myself have to acknowledge a similar lack of acquaintance with Dr. Major's observations.

Last year, in the columns of 'The Field,' I directed attention to the occurrence of a vestige of the Hipparion's face-pit in the skull of an Indian domesticated Horse in the collection of the British Museum. A side view of this skull is given in the accompanying text-figure (84), from which it will be seen that the

Text-fig. 84.

Side view of skull (without lower jaw) of Domesticated Horse from India, showing rudimentary face-pit.

lachrymal pit forms a very shallow and nearly circular depression in the bone a short distance in front of the orbit, in just the same position as the much deeper pit occupies in the Hipparion skull. The only other skull of a domesticated Horse in which I have noticed a similar depression is that of the well-known racer "Bend Or," in which it is still shallower.

From the occurrence of the feature in question in these skulls, both of which probably belonged to horses of Eastern origin, and its entire absence in all the skulls of the Prehistoric European horse, I have ventured to suggest that the "blood-horse," unlike the "cold-blooded horse" of Western Europe, may possibly have been the descendant of *Equus sivalensis*. Nor do I think this suggestion in anywise weakened by Dr. Major's earlier discovery of a rudiment of the face-pit in the European *E. stenonis*, since it had apparently disappeared in the Pleistocene horse of Western Europe.

As regards the aforesaid observations of Dr. Forsyth Major, which lead up to the main object of the present communication, it is stated in the passage already cited that the figure of the skull of the Quagga given in de Blainville's 'Ostéographie,' genus *Equus*, pl. iii., displays a distinct vestige of the pit for the face-gland. Inspection of the plate fully confirms this statement. Struck with this remarkable peculiarity, I examined the Quagga's

* Abh. Schweiz. pal. Ges. vol. vii. p. 140.

skull in the British Museum, belonging to a specimen formerly living in the Zoological Society's Gardens, of which the mounted skin is exhibited in the public gallery. As shown in the accompanying text-figure (85), this skull likewise displays a very distinct vestige of the face-pit. Since this structure is thus shown to be present in the only two skulls of the Quagga which have hitherto come under my notice, the presumption is that, if not a constant, it is certainly a very common feature of the species.

Text-fig. 85.

Skull of Quagga in the British Museum, showing vestige of depression for the face-gland.

Apart from the interest attaching to the occurrence of this vestige of the Hipparion face-gland in a second existing species of the genus *Equus*, the feature in question has an important bearing on the suggested identification by Mr. Pocock* of the Bonte-Quagga† (*E. burchelli*) with *E. quagga*. I have examined all the skulls of *E. burchelli* in the Museum—and there are a good many—and in not one of them have I found any trace of a depression for the face-gland. And it would accordingly seem (so far, of course, as the available evidence goes) that the presence or absence of this feature forms a distinction between *E. quagga* and *E. burchelli*; and, I may add, a distinction which I think ought to be regarded as of specific value.

In this connection I may mention that in the type-figure of the Quagga given in Edwards's 'Gleanings in Natural History,' as well as in the photograph by York of a living specimen in the Zoological Society's Gardens, and in the mounted skin in the British Museum, the pattern on the forehead forms a shorter and more regular diamond than in the Bonte-Quagga. Moreover, in the aforesaid three specimens of the former animal there are eight dark bars between the eyes, so that the centre of the diamond is light. In the Amsterdam Quagga there are ten. On the other hand, in all the specimens of the Bonte-Quagga that I have seen

* Ann. Mag. Nat. Hist. ser. 7, vol. x. p. 306 (1902).

† I think this name, which is used by Cornwallis Harris, is far preferable to "Burchell's Zebra."

the number of dark bars varies from five to nine, thus making the centre of the diamond a dark line *. All this tends to confirm my view of the specific distinctness of *E. burchelli* from *E. quagga*.

I may here take the opportunity of referring to another point in connection with the markings and coloration of the Quagga. Both Mr. Pocock † and myself ‡ have suggested that the Quaggas figured by Edwards in the work cited above, by Harris in the 'Game Animals of South Africa,' and by Hamilton Smith in Jardine's 'Naturalist's Library,' may be subspecifically distinct from the one figured by York and the specimens preserved in various museums; and I have even gone so far as to propose separate racial names for two of the latter. Apparently Cornwallis Harris was also of the same opinion, as at the end of his description of the Quagga he gives an illustration of the skin "of an animal exhibited in the Zoological Gardens as a Quagga."

Having obtained a considerable number of photographs, I am now very doubtful whether the presumed division into races is justifiable, although it is possible that the Vienna specimen § may be distinct; and, despite certain differences in regard to the width and backward extension of the stripes and also the relative proportions of the white and fawn areas, I am disposed to regard the Quaggas figured by Edwards, Harris, and Smith as representing the same type of animal. Incorrect drawing and colouring (which is noticeable in many of Harris's plates) will, I think, account for most, if not all of the differences.

All these plates represent a pale rufous or fawn-coloured animal, with white limbs and underparts, and black stripes on the head, neck, and fore-quarters; such stripes extending in Edwards's figure backwards on to the flanks and croup, where they break up into lines of spots.

From this general type I am unable to separate the two Quaggas drawn by Waterhouse Hawkins from specimens living at Knowsley, and figured by Gray in his 'Knowsley Menagerie.' It is true that their ground-colour is very much less rufous than in the specimens figured by Edwards, Harris, and Smith, but this may perhaps be accounted for either by more accurate attention to nature, or by the European climate having tended to darken the Knowsley specimens. Be this as it may, the latter are distinctly and unmistakably fawn-coloured animals with blackish-brown stripes; such stripes extending farther back on the quarters in one specimen than in the other.

On the other hand, in the British Museum mounted specimen and all the available photographs of Quaggas (whether from living or stuffed examples) the head and fore-quarters display white stripes separated by broader dark intervals which appear to be of

* This is shown in the figure of *E. burchelli* in Proc. Zool. Soc. London, 1903, ii. p. 197.

† Ann. Mag. Nat. Hist. ser. 6, vol. xx. p. 38 (1897).

‡ 'Knowledge,' vol. xxv. p. 20 (1902).

§ Proc. Zool. Soc. London, 1902, i. p. 32.

the same general colour as the unstriped hind-quarters. This type of colouring is very conspicuous in the Quagga in the Amsterdam Museum (text-fig. 86)*.

From the occurrence of these white stripes Mr. Pocock and myself have been induced to regard all the mounted specimens of the Quagga now remaining, together with the one represented in York's photograph, as racially distinct from the Quaggas figured by the older writers. This, if true, would certainly be a very remarkable circumstance; and I have now come to the conclusion that it is not supported by the evidence.

Text-fig. 86.

Quagga in the Amsterdam Museum.

I now believe, in fact, that the difference between the coloration of the stuffed Quaggas and the figures taken from living animals or fresh skins is entirely due to fading. On the head, neck, and fore-quarters the original blackish-brown stripes have faded to a brownish fawn similar to that of the hind-quarters; while the fawn intervals between the black stripes have bleached to white. The result of this is to produce a type of coloration quite distinct

* Mr. G. Renshaw ('Zoologist,' 1901, p. 48) has stated that the Amsterdam Quagga is one of the Knowsley specimens painted by Waterhouse Hawkins. This, however, is denied by Dr. C. Kerbert, Director of 'Natura Artis Magistra,' who wrote to me as follows:—"I beg to state that the Quagga bought by our Society at Lord Derby's sale, received Oct. 31st, 1851, died on January 2nd, 1853. The mounted specimen in our Museum was an animal bought May 9th, 1867, which died on the 12th of August, 1883."

from the original one—namely, a fawn-coloured animal with white stripes.

A similar effect is produced in the living animal, as exemplified in York's picture, by photography.

I explain this by the supposition that the light fawn bands between the dark bars of the Quagga, which evidently correspond to the white stripes of Grant's Bonte-Quagga, had a less stable pigment than the fawn of the rump; and that in dead specimens long exposed to the light these light areas (which were originally of the same colour as the rump) faded to white, and also come out white in photography; while in both cases the more stable fawn of the rump (the typical ass-colour) retained its original tint, or approximately so.

Whether the very curiously marked Quagga in the Vienna Museum figured in the Society's 'Proceedings' for 1902 (i. p. 32) indicates a distinct race I leave undecided, but, in any case, I think that its coloration is due to the same cause as that above mentioned.

Reverting, in conclusion, once more to Dr. Major's observations, I have to notice the record of the presence of a vestige of the pit for the face-gland in the skull of a young Ass. Apparently a trace of a similar feature exists in one of two young skulls of that species in the collection of the Museum, so that its occurrence would seem to be only occasional. Nevertheless, this suffices to allow the statement that vestiges of the pit for the face-gland are now known to occur in the skulls of three existing species (including the Quagga in this category) of the Horse family, in one of which it appears to be constant.

2. Note on the Wild Ass of Mongolia.

By R. Lydekker.

[Received March 10, 1904.]

(Plates XXVII. & XXVIII.*)

My attention has been directed by the President to a Wild Ass in his Grace's collection at Woburn Abbey, which was received with the Mongolian wild ponies, and is stated to have been obtained as a colt in Kobdo, north-west of the Gobi Desert. This animal, which is a male, is therefore about three years old, and thus approaching its full stature. The sketch reproduced in the accompanying Plate XXVII. was made in June 1903, at a time when the summer coat was at its best.

In its make and actions—especially of starting when alarmed with the head so elevated that the plane of the face is almost horizontal—as well as in the general type of coloration, this Wild Ass agrees essentially with the Kiang of Ladak and Tibet. Both

* For explanation of the Plates, see p. 432.

in the winter and summer coat it lacks, however, the distinctly rufous-chestnut tint so characteristic of the latter, while it is further characterised by the much less marked contrast between the light and dark areas of the coat; the light areas on the muzzle, buttocks, legs, and underparts being "isabella-coloured" instead of pure white, and thus much less sharply differentiated from the fawn of the rest of the body. The general colour is pale sandy fawn, with the tips of the ears, mane, dorsal stripe (which is continued down the tail) brown; and there seems to be but little difference in this respect between the summer and winter coats. The dorsal stripe is narrow, as in the Kiang, and thus distinct from that of the Ghor-khar and Onager, which is broader and bordered with white. In order to show the difference between the present animal and the true Kiang, I give (in Pl. XXVIII.) a coloured illustration of the latter, for which the Society is also indebted to its President.

I take it that the Woburn animal is the true *Equus hemionus* of Pallas*, which came from Mongolia, and is known to the natives as the Chigetai (Dziggetai). It is certainly entitled to be regarded as subspecifically distinct from the Kiang of Tibet and Ladak, and the latter should accordingly be known as *Equus hemionus kiang* Moorcroft. Judging from its coloration, the Chigetai should be an inhabitant of more desert country than that frequented by the Kiang; and by comparing accounts of the Gobi with what I know of Ladak, this would seem to be the case. In separating these two forms I am in accord with Dr. Matschie (SB. Ges. naturfor. Fr. Berlin, 1893, p. 208).

If the Chigetai and the Kiang are regarded as races of one species, there would seem considerable reason for considering the Onager and the Ghor-khar as subspecies of a second; for the two latter certainly differ from the two former much more than do the members of the two groups from one another. In their tendency to a greyer colour, smaller hoofs, and possibly in a greater length of ear, the two southern forms present an approximation to the true Wild Asses of Africa, which is quite what we might expect from their geographical distribution. In colour, and perhaps also in length of ear, as well as in their cry, the Chigetai and the Kiang are more horse-like.

EXPLANATION OF THE PLATES.

Plate XXVII.

Male Chigetai (*Equus hemionus*) from Kobdo, now living at Woburn Abbey, in summer coat.

Plate XXVIII.

Female Kiang (*Equus hemionus kiang*), from a Ladak specimen, in the summer coat, at Woburn Abbey.

* Nov. Comm. Petrop. xix. p. 397, pl. 7 (1775).

3. Description of a new Species of Spot-nosed Monkey of the Genus *Cercopithecus**. By R. I. Pocock, F.Z.S., Superintendent of the Gardens, formerly Assistant in the Zool. Dept., Nat. Hist. Museum.

[Received March 15, 1904.]

(Text-figure 87.)

[The complete account of the new species described in this communication appears here; but as the name and preliminary diagnosis were published in the Abstract, the new species is distinguished here by being underlined.—Editor.]

CERCOPITHECUS SCLATERI. (Text-fig. 87.)

Cercopithecus sclateri Pocock, Abstr. P. Z. S. 1904, No. 5, p. 18, March 22.

Naked integument round orbits blackish, probably bluish when living; eyelids and upper lip a dirty greyish yellow, probably flesh-coloured when living. Nose covered with a large subtriangular patch of hair, extending almost from the interorbital line, where it is acutely angular, to the extremity of the nose, from which, in the specimen described, the hair appears to have been worn away; laterally the patch is produced towards the cheeks into an acutely angular point, the entire area being nearly twice as wide as long; the hairs composing it are for the most part white, the extreme margin and the upper interorbital angle being tinged with pale red. No black superciliary band, the reddish-white bases of the backwardly inclined hairs of this region forming a pale supraorbital line. On each side from the corner of the orbit backwards across the temple runs a black band which expands towards the ear, reaching with its inferior edge the middle of the base of that organ; while its upper edge, running above the ear, is continued across the back of the head to meet at an obtuse angle with its fellow of the opposite side; the area on the top of the head, thus circumscribed, is covered with hairs banded alternately yellow and black, those on the antero-lateral angles of the area being longer than elsewhere. Beneath the temporal band on the cheek there is a band of grizzly-yellow hairs, which extends backwards beneath the ear on to the neck, and, increasing in width and yellowness in front, runs downwards and forwards to a point to meet the external angular extension of the nose-patch. This yellowish cheek-band is bounded below by a band of black hairs, which rises anteriorly upon the external area of the upper lip between the corner of the mouth and the angle of the nose-patch; narrowing posteriorly it forms a sinuous curve, ascending on the middle of the cheek and descending and becoming

* The spot-nosed species of *Cercopithecus* have been monographed of late years by:—P. L. Sclater, P. Z. S. 1893, pp. 244–247; Matschie, SB. Ges. nat. Freunde Berlin, 1893, pp. 94–101; H. O. Forbes, Allen's Nat. Libr., Monkeys, vol. ii. pp. 44–54 (1894).

Text-fig. 87.

A

B

(Cercopithecus [illegible]) showing A and B views of head.

evanescent towards the ear. The direction of the hairs of this band follows its curvature. Beneath it the cheek is a dirty greyish white, which gradually passes into the grizzly-yellow colour of the sides of the neck. A scanty fringe of white hairs upon the ear. Occipital area blackish. Nape of neck and shoulders speckled yellow and black; between the shoulders and the root of the tail the coat is speckled black and rich coppery yellow. Arm externally speckled yellow and black, becoming blacker upon wrist and hands and upon the posterior side below the elbow. Leg externally speckled yellow and black to the upper side of the foot; much more sobre-tinted than the sacral region, but the tints of the two areas blending imperceptibly, without any intervening line of demarcation. The whole of the underside grey, whiter upon the chin, where there are some black hairs, and upon the throat; dusky olive-grey upon the chest and belly, where the hairs are apically annulate; inner side of arms and legs also dark ashy grey. Upper side of tail in its basal half speckled red and black, redder than the sacral region, although the tints of the two areas pass gradually into one another; posteriorly the upper side becomes gradually yellower, then greyish black, with the terminal hairs quite black; underside of tail deep rusty red in its basal half, passing into ashy grey posteriorly, a sharp line of demarcation between the tints of the upper and under side. Some rusty-red hairs upon the perinæal region and scrotum.

Measurements of dried skin:—From crown of head to root of tail 14½ inches (363 mm.); length of tail 24½ inches (613 mm.).

Loc. W. Africa: Benin.

This species is based upon the skin of a young male specimen with complete but unworn dentition, that was deposited in the Gardens by Mrs. Pickering Phipps on July 12th, 1902, and died on the 8th of August in the same year.

I have much pleasure in dedicating the species to Dr. P. L. Sclater, who, recognising the importance of preserving material of this genus, instructed Mr. Ockenden, the assistant to the Society's Prosector, to skin examples of the genus *Cercopithecus* that died in the Zoological Gardens. It was largely upon material thus obtained that Dr. Sclater based his monograph of this genus published in the 'Proceedings' for 1893.

The form of the nose-spot points to affinity between this species and *C. cephus* and *C. erythrotis*. From *C. cephus* it differs mainly in the following characters:—(1) The hairiness of the nose; (2) the absence of moustache-band; (3) the pallid upper lip and chin; (4) the sinuous curvature of the black cheek-band; (5) the extension of the grey tint of the throat up to the level of a line joining the nostril and lower edge of ear; (6) the presence of a black occipital band as strongly defined as in *C. petaurista*; (7) the shortness of the white ear-fringe; (8) the presence of red hairs upon the scrotum and all along the proximal portion of the underside of the tail.

It is nearer to *C. erythrotis*, but may be at once distinguished

by: (1) the absence of the black superciliary band; (2) the white colour of the nose-spot and of the hairs upon the ears; (3) the presence of the occipital band; (4) the grizzled colour of the forearm; and (5) by the restriction of the red on the tail to the proximal half of its under side.

The constancy of the above-mentioned characters in *C. erythrotis* has been tested upon five skins, four of which, including the type, are in the collection of the British Museum; the other, belonging to the Zoological Society, is that of a specimen that lived for four years in the Gardens, and was mentioned by Dr. Sclater in his monograph of the genus *Cercopithecus* (P. Z. S. 1893, p. 246). This specimen is ticketed Fernando Po; and the same locality is assigned to the type and to two other skins in the British Museum, the remaining skin in that institution being labelled "W. Africa, G. Burton."

The last-mentioned skin was taken from a small and presumably very young individual. The length of the body from the occipital interaural area to the root of the tail is about 10½ English inches (= 263 mm.), and the tail itself about 16 English inches (400 mm.). It is thus a much smaller Monkey than the type of *C. sclateri*, and proves beyond doubt that the coloration of the young *C. erythrotis* is practically the same as the adult, except that the back and tail are darker and less rufous. Hence it may be inferred that the coloration of the type of *C. sclateri* would not have altered appreciably had the specimen lived to maturity.

It is unfortunate that none of the British Museum skins of *C. erythrotis* are sexed. The one belonging to the Zoological Society is a female; and since the only known example of *C. sclateri* is a male, it is conceivable that the differences pointed out above are sexual. But the analogy of *C. cephus*, a nearly related form, in which the sexes are alike in colour, affords no support to such a conception. Finally, it may be interesting to point out that the principal points of difference between *C. sclateri* and *C. erythrotis* may be ascribed to a deficiency of red pigment in the hairs upon the nose, the ears, and the greater part of the tail. In fact *C. erythrotis* might with some justice be described as an erythristic form of *C. sclateri*, so far, at least, as the areas named are concerned.

4. Contributions to the Anatomy of the Lacertilia.—(1) On the Venous System in certain Lizards. By FRANK E. BEDDARD, M.A., F.R.S., Prosector to the Society.

[Received February 23, 1904.]

(Text-figures 88–94.)

I have found that the best method of studying the venous trunks of these lizards is to divide the anterior abdominal vein and then to inject both anteriorly and posteriorly; no valves stop

the flow of the injected fluid, which passes freely into the system of the vena cava as well as into the vessels of the various portal systems. In this way I have found it possible to make accurate sketches (as I hope) of the course of the veins in certain Lizards, and to add something to the existing knowledge of the subject. This knowledge is, however, already very considerable, but refers mostly to *Lacerta*, of the venous (and arterial) systems of which there are many excellent figures *. These sources of information are, however, mainly concerned with the more general aspects of the circulatory system, and many details are absent. Thus Jourdain †, in figuring ‡ the vena cavæ and anterior abdominal vein, omits the epigastric veins, and his figure § of the suprarenal portal system takes account of a few vessels only—unless, indeed, *Lacerta* differs greatly from the type which I myself have examined. This criticism cannot be applied to the most recent and the most important memoir upon the subject known to me—that of Hochstetter ||.

This memoir contains, in addition to embryological observations, a number of facts relating to the venous system of the adult *Lacerta* and some other genera of Lizards, together with a bibliography. I shall refer to the facts detailed by Hochstetter in the course of the following contribution to our existing knowledge of the venous system of the Lacertilia.

Iguana tuberculata.

Of this species I have dissected three examples, all of them females.

The *vena cava posterior* lies entirely to the left side of the mesorectum, instead of on the right side as in *Tiliqua*. It arises by two branches, one from behind the middle point of each kidney and quite concealed by the pelvis. At about the middle of the kidney the vein divides into the larger vena cava which runs on the right side and a smaller left branch.

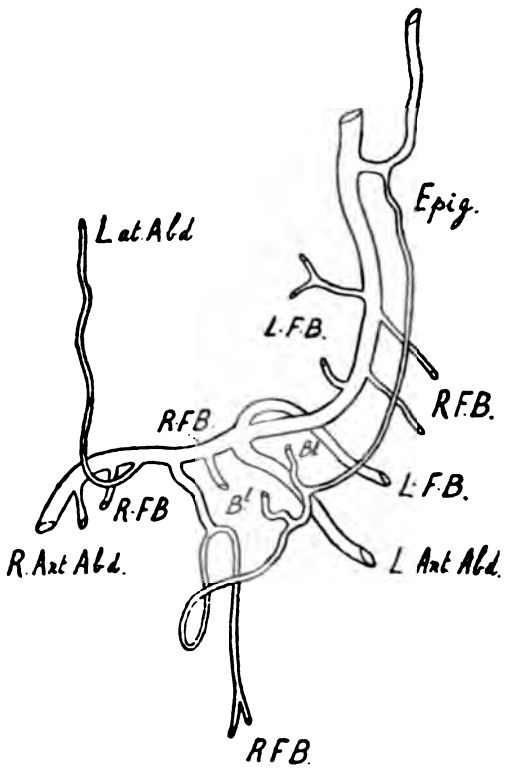
Anterior Abdominal vein.—The accompanying drawing (text-fig. 88, p. 438) illustrates the detailed branching of the anterior abdominal system, which is more complicated than that of *Tiliqua* which I describe later. At its origin from the vena advehens anterior the abdominal vein receives several branches from the parietes both right and left. The veins from the two fat-bodies do not only form their respective halves of the abdominal vein. After the junction of the two vessels to form the median unpaired anterior abdominal, three branches from the right and two from the left fat-body join the anterior abdominal. The exact details are shown in the drawing to which I have already referred.

Epigastric vein.—The median epigastric vein is constructed

* For instance, in Parker & Haswell, 'Text-book of Zoology,' London, 1897.
† "Recherches sur la veine porte rénale," Ann. Sci. Nat. (4) xii. p. 134.
‡ *Loc. cit.* pl. xi. fig. 1. § *Loc. cit.* pl. xi. fig. 2.
|| "Beiträge z. Entwicklungsgeschichte des Venensystems der Amnioten, ii. Reptilien," Morph. Jahrb. xix. p. 428.

more on the plan of the epigastric system of *Tiliqua* than on that of *Varanus*. It arises chiefly from the anterior abdominal, some way before the entry of the latter into the liver, and runs forward to the liver, which it enters in common with the last of the three ventral parieto-hepatic veins. Posteriorly, I am inclined to think, it is continuous with a slender vessel arising from the bladder in common with certain branches of the anterior abdominal vein (see text-fig. 88). Its course, at least anteriorly,

Text-fig. 88.



Anterior abdominal and median epigastric vein of *Iguana tuberculata*.

Bl., veins of bladder; *Epig.*, median epigastric; *L.Ant.Abd.*, left root of anterior abdominal; *L.F.B.*, veins of left fat-body; *Lat.Abd.*, lateral abdominal; *R.Ant.Abd.*, right root of anterior abdominal; *R.F.B.*, veins of right fat-body.

is accurately along the ventral median line. The lateral epigastric veins are well developed and are like those of *Varanus*; they spring from the anterior abdominals nearer to the union of these vessels in the middle line than do the posterior vertebrals. I

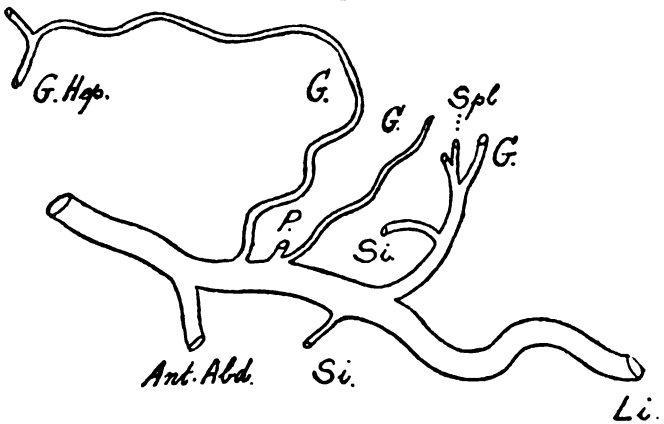
have seen this vessel throughout its whole course only on the right side of one specimen. In this specimen the vein bifurcates at about the middle of the liver, and the one branch joins the first of the ventral hepato-parietals; the other branch is prolonged forwards and joins the brachial vein.

Lateral Abdominal veins.—These veins in *Iguana* are short, and perhaps this condition is to be correlated with the conspicuous development of the lateral epigastrics *. Each springs close to the root of the anterior abdominal on either side in company with two small parietal veins (text-fig. 88). I could trace them forwards only as far as the level of the suprarenal bodies, where they become continuous with the veins of the same.

Azygos vein.—Anteriorly the azygos vein is exposed on the left side for a space of three or four vertebræ. I traced it beneath the subclavian artery and as far as the third following intercostal artery. On the right side the vein disappeared from view at the level of the origin of the right subclavian. Two specimens were alike.

The *gastro-intestinal* branches of the *Portal vein* are either four or five and they are as follows:—Posterior to the opening of the

Text-fig. 89.



Alimentary portal system of *Iguana tuberculata*.

Ant.Abd., anterior abdominal vein; *G.*, gastric veins; *G.Hep.*, gastro-hepatic; *Li.*, trunk from large intestine; *Si.*, branches from small intestine; *Spl.*, splenic vein; *P.*, pancreatic vein.

anterior abdominal vein is a branch supplying the stomach and pancreas; this follows the curvature of the stomach, and is connected anteriorly with the last of the gastro-hepatic veins. Then follows another gastric vein which draws blood from the opposite side of the stomach; in the second individual this vein joins the first

* According to Hochstetter this vein is absent in *Uromastix*.

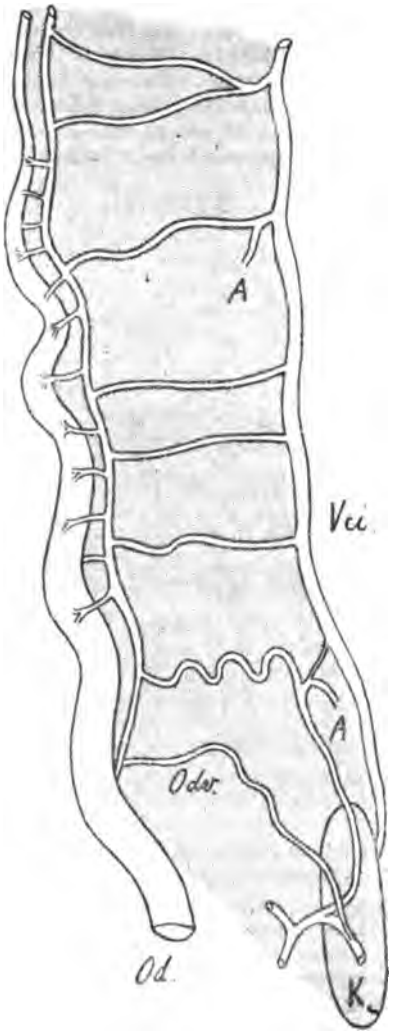
gastric before entering the portal vein. The remaining veins are similar in the two specimens. The first to join the main trunk of the portal is a vein from the small intestine; then follows a much larger trunk, which first of all receives a branch from the small intestine and then divides into two—one splenic and the other gastric. The main trunk is continued along the large intestine, receiving blood from the latter and from the cæcum. It will be noticed, therefore, that the portal system of the alimentary canal in *Iguana* differs in several points from that of *Tiliqua*, notably in the difference between the branches from the stomach and from the small intestine. A last point in the portal system of this Lizard to which I desire to call attention is a direct connection between the portal system and the systemic veins. A minute vein, which would certainly escape attention in a specimen that had not been injected, arises from the portal vein just at the cæcum, and passes along the mesentery to join the branch of the inferior vena cava which supplies the left ovary.

Ventral Hepato-parietal veins.—These veins are either two or three in number. The last of them, *i. e.* that entering the liver nearest to its posterior end, receives a vessel from the anterior abdominal vein, to which reference has already been made (on p. 438). It emerges from the body-wall in the middle line. The middle vessel is formed by the junction of at least three branches—two of these run anteriorly and posteriorly respectively in the middle line, and the former receives a branch from the right side. The most anterior of the three ventral hepato-parietal veins arises from the left side of the ventral median line. Where there are only two ventral hepato-parietal veins, it appeared to me that the anterior of the two represented the two anterior veins of the first specimen fused together. In the third specimen which I dissected (which was not injected) the anterior of the three veins has two important branches which I did not observe in the other specimens. One of these joins the epigastric, as has already been described. The second branch runs forwards and downwards and traverses the middle line of the sternum below the skin; it is exactly comparable to a vein already described in *Tiliqua*, of which the homologue also appears to exist in *Varanus*.

Dorsal Hepato-parietal veins.—There are either one or two of these veins on the right side, which enter the liver close to the entrance of the vena cava. Where there are two the posterior vein, as will be explained, is detached from the suprarenal system. The more usual single vein in one of the two individuals arises from the parietes and passes along two vertebræ before entering the liver, from which it receives two intercostal branches which are hidden below the musculature. Corresponding to it on the left side of the vertebral column another vein emerges from the parietes and divides into two branches, which embrace the aorta and become continuous with various branches on the stomach which ultimately join the two gastro-hepatic veins already

described. In the second specimen the conditions were a little different. The hepato-parietal of the right side, just after leaving the liver, gives off a superficial branch to the parietes which belongs to the same series as those which combine to form the additional hepato-parietal vein already referred to. It then

Text-fig. 90.



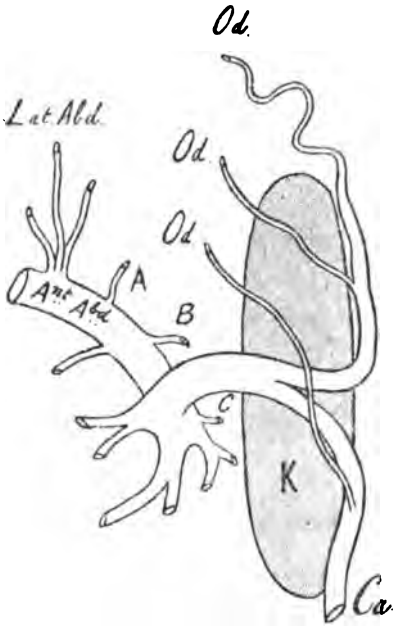
Oviducal veins of *Iguana tuberculata*.

A, parietal veins; *K*., kidney; *Od*., oviduct; *Odv*., oviducal vein; *Vci*., vena cava.

divides into two equally-sized branches, one of which plunges at once into the parietes at the side of the vertebral column; while the other is continued forwards, and finally ends just opposite to the emergence (on the left side of the vertebral column) of the left dorsal hepato-parietal vessel, which passes to the liver by way of the stomach.

The *Oviducal veins* (text-fig. 90, p. 441) are somewhat complicated. A continuous vessel, much contorted to allow for necessary stretching, runs along the oviduct. Into this open altogether eight transversely-running veins in the case of both oviducts. These may be divided into two series. The first six communicate directly with the vena cava; the last two belong to the afferent renal system. The six anterior oviducal veins seem, at least occasionally, to receive branches from the suprarenal body which lies in close contact

Text-fig. 91.



Veins of kidney of *Iguana tuberculata*.

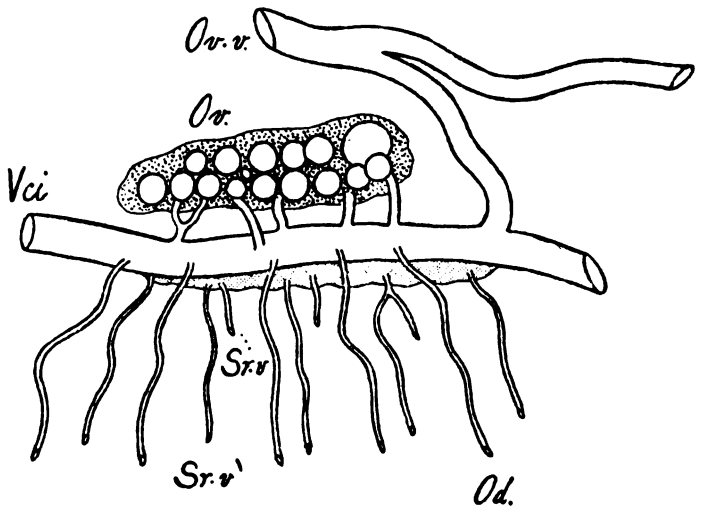
A, *B*, *C*, parietal veins; *Ant.Abd.*, anterior abdominal; *Ca.*, caudal vein; *K.*, kidney; *Lat.Abd.*, lateral abdominal; *Od.*, oviducal.

with the vena cava. In the case of the right oviduct the first of the oviducal vessels which are connected with the renal system has a rather complicated course. It is a very stout vessel, and runs very nearly as far as the right vena cava, where it divides into two branches (see text-fig. 91). The anterior of these branches

gives off a very slender twig, which appears to enter the vena cava and then plunges into the parietes to the right of the middle line. The posterior branch runs over the kidney and becomes continuous with the vena renalis advehens, which enters the kidney at about the middle of its length. The last vein leaving the oviduct is, as I believe—though I am unable to be quite certain—continuous with the caudal affluent of the kidney.

Suprarenal Portal veins.—These vessels are more complicated in *Iguana* than they are in *Tiliqua* or, according to Hochstetter's figure, in *Lacerta viridis*. There are two series of these veins, distinguished by their greater or less length. One specimen possessed five of the longer vessels and three of the shorter on each side. The shorter ones correspond to the suprarenal

Text-fig. 92.



Ovarian and suprarenal veins of *Iguana tuberculata*.

Od., oviducal veins; *Ov.*, ovary; *Ov.v.*, ovarian vein of opposite ovary; *Sr.v.*, shorter, *Sr.v.'*, longer suprarenal veins; *Vci.*, vena cava.

portals present in *Tiliqua*; and, as in that lizard, they arise from the body-wall not far from the ventral median line. Of the longer vessels, which emerge from the body-wall much further away from the ventral median line, there were five in one specimen, of which three, on the left side of the body, united before reaching the suprarenal body. Some at least of these longer vessels are connected, as already mentioned, with the posterior vertebral vein. In the other specimen of *Iguana* there was an interesting modification of this arrangement. The last three vessels of the longer series, at any rate on one side of the body, instead of passing to

the suprarenal body became fused into a single trunk pouring its blood into the liver between the entrance of the dorsal parietal portal and of the vena cava posterior. In this specimen, moreover, the left posterior vertebral vein emerges from the parietes some way in front of the gonad, and, running superficially, forms an additional blood-supply to the suprarenal body.

Tiliqua scincoides.

Of this lizard I have dissected two individuals, both of them males; in only one was the venous system injected. The most noteworthy character in the venous system of this lizard is the great disproportion between the right and left *vena renalis revehens*. As a rule there is an inequality in these vessels, the right being larger than the left. In the present species (text-fig. 93, p. 445) the left is so small that it seems to be on the verge of disappearance. I did not trace it in the injected specimen as far as the kidney. The right vein lies to the right side of the mesorectum, and the branch putting it into communication with the left vein can be seen to perforate that membrane; the branch is large; it is only after receiving the veins from the left gonad that it dwindles and finally disappears. The right *vena renalis revehens* receives only one branch from the right testis.

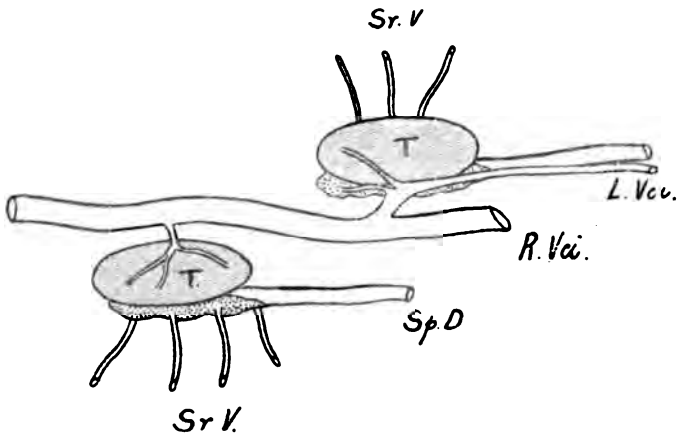
The *anterior abdominal vein* arises on each side much as in *Iguana*. There are, however, differences of detail. After the origin of the ischiadic vein from two roots it divides into the anterior abdominal and the *vena renalis advehens*; the latter reaches the kidney much more anteriorly than in *Iguana*, and instead of running over the kidney superficially it buries itself in its substance well before reaching the inner border. The anterior abdominal vein receives two intercostals and one parietal vein on the outer side before becoming confluent with the posterior vertebral. A long vein from the bladder and also branches from the fat-bodies join the anterior abdominals before they unite to form the median trunk. At the point of junction a median vessel from the under surface of the pelvis joins the anterior abdominal; this is composed of a branch from each leg and a median backwardly-running branch. It is a curious fact that these vessels show an asymmetry precisely similar to that which I have observed in *Varanus*. In both lizards the vein to the right leg joins the median trunk anteriorly to that point at which the vein from the left leg joins it.

Suprarenal Portal veins.—In one individual there were three of these veins to each suprarenal body; in another specimen (text-fig. 93, p. 445) there were four on the right side and three on the left. The veins lie between the intercostal arteries and follow the ribs; they emerge from the parietes at a greater distance from the middle line than the arteries which enter the parietes.

Intestinal Portal veins.—The portal vein is made up of seven affluent veins. The first is the gastric; next to this is a vessel

from the stomach and pancreas, which is followed by a small duodenal. Then two important vessels debouch into the portal vein opposite to each other, one from the small intestine, the other from the spleen. A third important trunk from the small intestine follows, and the vein of the colon completes the series.

Text-fig. 93.



Vena cava and spermatic veins of *Tiliqua scincoides*.

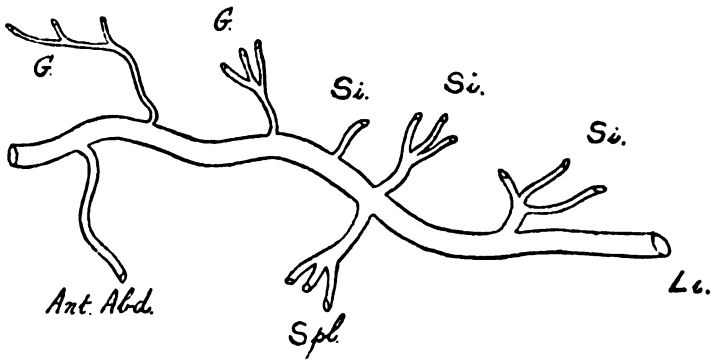
L.Vci., left vena cava or vena renalis revehens; *R.Vci.*, right ditto; *Sp.D.*, sperm-duct; *Sr.V.*, suprarenal veins; *T.*, testes.

Epigastric veins.—These are not so fully developed as in *Varanus*, and are somewhat different in other respects. The vessel enters the liver anteriorly, as is the case with *Iguana*, and receives a few branches from the ventral parietes. The intimate relation of the epigastric to the anterior abdominal contrasts with the conditions obtaining in *Varanus*. Furthermore, it will be apparent that this vein is equivalent to a vein in *Iguana* which is lettered *Epig.* in the sketch of the anterior abdominal system of that lizard (text-fig. 88, p. 438), and that therefore it represents only a portion of the epigastric system of *Iguana*. The paired epigastrics of *Iguana* I have been unable to find in either specimen of *Tiliqua*.

Dorsal Hepato-parietal veins.—Only one vein, as is apparently the general rule among Lizards, enters the narrow posterior prolongation of the right liver-lobe; where the vein enters it is quite as thick as the vena cava posterior. It runs forward along the right side of the vertebral column, and after giving off about four intercostal branches, two to right and to left, disappears from view. There is no communication with the œsophagus such as exists in *Iguana*. It agrees very closely with the corresponding vein in *Varanus*.

Lateral Abdominal veins.—These veins are seen at their simplest in the present genus, as also in *Iguana*. Each vein arises from the femoral vein of its own side, and runs forward within the body-cavity in close attachment to the parietes; the vessel on each side lies in the angle formed by the bending of the parietes to constitute the lateral walls of the body; they are thus about equally far removed from the mid-dorsal and mid-ventral lines. The veins give off branches to it where they perforate the obliquely-running membrane which supports on each side the bladder, and shuts off the fat-body from the front part of the abdominal cavity. The vessels are visible as far forwards as the end of the lungs, where they become lost in the parietes. There is no superficial connection between these veins and the renal portal veins. The anterior region of the same vein, *i. e.* the azygos, runs from the jugular along the vertebral column, but on the right side in both specimens, whereas in *Iguana* it is on the left. It is noteworthy that such a difference in position occurs also among mammals.

Text-fig. 94.



Alimentary portal system of *Tiliqua scincoides*.

For lettering see text-fig. 89, p. 439.

Ventral Hepato-parietal veins.—The regular number of these veins in *Tiliqua gigas* appears to be three; but in one of the two individuals examined by me there was a very slender additional vein entering the liver just behind the anterior of the three. The last of the three veins, as in *Iguana* (see p. 440), joins the median epigastric vein, not very far from the entry of the latter into the liver; on its way it gives off one or two branches to the ventral parietes in the middle line. Concerning the middle vein there is nothing particular to be said. The anterior vein is very remarkable, and quite different from the corresponding vein in *Iguana*. In runs straight from the liver to the ventral parietes, which, however, it perforates in the middle line and behind the

sternum. The vein reappears just below the skin and just superficial to the musculature, passing forwards along the ventral middle line to the neck. Before terminating on the neck the vein gives off a branch on each side, which runs down the neck among the muscles a little anteriorly to the origin of the fore limb. I traced the vein on one side to a point close to the auricles, and I think that it communicates with the jugular vein. Since the vessel showed no diminution of calibre up to the point where I lost it (owing to the failure of the injection), I do not think that it can arise from a capillary network on—for example—the heart. As to the course of the blood in this vessel I have of course no positive facts to offer; I believe, however, that the blood must flow towards the liver—that the vessel is, in fact, part of the portal system, chiefly for the reasons that if the vein be regarded as an hepatic vein its course would seem to be unnecessarily erratic. A connection between the head-end of the body and the hepatic or other portal systems is not common in reptiles; but I shall presently have to refer to analogous cases in the Monitor (see below, p. 449).

Gastro-hepatic veins.—This lizard has a well-developed system of gastro-hepatic vessels, by which I understand those veins which communicate directly between the stomach and the liver and do not reach the latter indirectly *via* the common portal vein. I find either three or four of these trunks, which are all of them situated anteriorly, and are supported by one or other of the two (right and left) gastro-hepatic ligaments. Anteriorly the two membranes in question become joined, and this unpaired region bears two of the veins; the next vein runs in the right and the last in the left sheet of the mesentery.

Varanus griseus.

Of this lizard I have dissected two examples, both of them males. The circulatory system has been described by Corti*; and Hochstetter† has added some details of value, which I have confirmed.

The original of the *anterior abdominal vein* is correctly described by Hochstetter, who figures the vessels‡. I may remark that each anterior abdominal receives before its union with its fellow only two branches from the fat-body, which contrasts with the larger number characteristic of *Iguana*.

Epigastric veins.—The right and left epigastric veins arise from the outer, sciatic, veins of the legs immediately behind the last of the branches which come from the fat-bodies. Each is closely accompanied by an epigastric artery, the course of which is not dealt with here. During their course along the ventral parietes the veins receive many branches from the parietes, and they finally end in the liver independently of each other. It is note-

* 'De Systemate vasorum Psammosauri grisei,' 1853. I am not acquainted with this work.

† Morph. Jahrb. xix p. 464.

‡ *Loc. cit.* pl. xvi. fig. 17.

worthy also that the entry of the veins into the liver is not coincident; the right epigastric enters that organ a considerable distance behind the entry of the left vein. Furthermore, each is associated with its own liver-lobe, right or left, though the point of entry into the same is only just right or left, as the case may be, of the median sulcus. In the larger specimen of *Varanus* the arrangement of these veins is slightly different in that the right epigastric enters the liver anteriorly to the left. Both veins, the right and the left, are continued forwards as well as backwards. On the left side I have ascertained that the anterior prolongation of the epigastric joins the mammary branch of the left jugular at a considerable distance from the heart. This branch seems to me to be quite comparable with the similar vein in *Tiliqua* (see p. 445), which arises, as I thought, from the jugulars and independently enters the liver; the main difference being that in *Varanus* the vein is double throughout, that it does not immediately underlie the skin for the greater part of its course, and that it fuses with the epigastric instead of entering the liver separately. Or this vessel in *Tiliqua* may be homologous with the single hepato-parietal ventral of *Varanus*, which I describe below. The epigastric of the left side, at any rate, gives off a branch to the fat-body of that side before joining the femoral vein.

Lateral Abdominal veins.—Occupying the same position as the corresponding vein of *Tiliqua*, the lateral abdominal veins of *Varanus* have somewhat different relations. There were furthermore differences in the two individuals which I dissected*. In the first place, the vein is more complete anteriorly than posteriorly, while in *Tiliqua* and *Iguana* the reverse is the case. In the latter the vein arises from the leg vein and runs forward for a varying distance. In *Varanus* the vein does not appear to be connected with the veins of the hind limb, but it is connected with veins in the anterior region of the body. It arises anteriorly from the jugular in common with the mammary vein and branch of epigastric. In one specimen there is a second branch from the jugular rather nearer to the heart. In this specimen, however, there is not a plain superficial connection between the lateral vessel arising from the two branches of the jugular. However, the vessel passes backwards, and after its second origin receives a branch from the lung. It ends posteriorly in the suprarenal vessels, as has been described in considering these veins. I thus confirm Hochstetter in denying the existence of an anastomosis between this vein and the anterior abdominals posteriorly.

Dorsal Hepato-parietal veins.—As in *Tiliqua*, there is but one vein, that of the right side. It either emerges from the parietes just below the point where it enters the liver or has a short superficial course, emerging rather further forwards; it gives off no branches to the left side such as are found in *Tiliqua*.

* Both specimens were entered on the books of the Society as belonging to the same species, viz. *Varanus griseus*. I can find no reason from external characters for criticising this identification.

Ventral Parieto-hepatic veins.—These veins as independent veins are poorly developed in *Varanus* as compared with the other types. There are at most three of them. The anterior corresponds to a vein which seems to be a characteristic vessel and always found in Lacertilia. But its distribution in *Varanus* is rather different. In one specimen the vein is formed by two affluents, one from the ventral parietes and the other from the stomach. Concerning the second specimen I am rather uncertain, but inclined to believe that there is also a connection with the mammary and epigastric branch of the jugular (see p. 448). In the second specimen, moreover, this vein enters the liver in company with the left epigastric. The second vein of this series is a medianly situated vessel which does not enter the liver independently, but is an affluent of the left epigastric. A third vessel enters the anterior abdominal vein near to its entry into the liver. Hochstetter observes*:—"Dass die Venen der vorderen Brustwand in der Sternalgegend nicht in dei Zweige münden, die als V. portae secundariae aufzufassen sind wie bei *Lacerta*, sondern in die vorderen Hohlvenen, findet in der Lage des Herzens und seiner grossen Gefässe bei diesem Reptil seine Erklärung." I am disposed myself to look upon the fact rather as indicative of a resemblance to *Tiliqua* and *Iguana*, which lizards, as has been mentioned, also have communications between the anterior veins and the portal system of the liver.

Summary.

Some of the more important new facts described in the foregoing pages may now be briefly recapitulated.

(1) While there is generally (?always) an inequality in size between the two venæ renales revehentes, *Tiliqua* is remarkable on account of the very reduced size of the left vein.

(2) While *Iguana* possesses three epigastric veins, two lateral and a median, the last only is developed in *Tiliqua*. *Varanus* has the lateral epigastrics which, as in *Iguana*, are connected anteriorly with the jugulars, but (? in correlation with the absence of a bladder) the median epigastric is at most rudimentary.

(3) The intestinal portal systems of *Iguana* and *Tiliqua* differ. In the former there are only two branches from the small intestine, one of which joins the gastro-splenic trunk; in the latter there are three veins, all of which open separately into the portal trunk.

(4) In both *Iguana* and *Tiliqua* there is a superficial vein lying beneath the skin but above the musculature and along the middle line of the sternum, which enters the liver posteriorly and appears to be connected with the jugulars anteriorly.

(5) *Varanus* has but one vein running from the stomach and œsophagus directly to the liver (*i. e.* not by way of the intestinal

* *Loc. cit.* p. 467.

portal system). In *Iguana* there are two such veins and in *Tiliqua* three.

(6) *Iguana* differs from both *Tiliqua* and *Varanus* in possessing dorsal parieto-hepatic veins which arise from both sides of the vertebral column. In *Tiliqua* and *Varanus* only the right vein is present, which enters the liver close to where it is perforated posteriorly by the vena cava. In *Tiliqua* this vessel receives intercostal branches (?) from the left side as well as from the right which cross the vertebral column superficially; these are not present in *Varanus*. The left dorsal parieto-hepatic vein of *Iguana* reaches the liver by way of a venous plexus on the stomach and the gastro-hepatic veins.

(7) The lateral abdominal vein, from where it joins the root of the anterior abdominal to a point anterior to this where it becomes defective, is very short in *Iguana* as contrasted with *Tiliqua*. In none of the types which I have examined is this vein continuous from one end of the body to the other as it appears to be (according to Hochstetter) in *Lacerta*.

(8) *Iguana* is to be distinguished from *Tiliqua* (and possibly from *Varanus*) by the more complex system of suprarenal portals; there are two sets of these vessels instead of only one.

(9) The two posterior of the oviducal veins in *Iguana* are connected each of them with one of the afferent veins of the kidney.

5. A Contribution towards the Knowledge of the Lepidoptera-Rhopalocera of Dominica, B.W.I. By PERCY I. LATHY, F.Z.S., F.E.S.

[Received March 5, 1904.]

[The complete account of the new species described in this communication appears here; but as the names and preliminary diagnoses were published in the 'Abstract,' such species are distinguished by being underlined.—EDITOR.]

In the 'Proceedings' of the Zoological Society for 1884 Messrs. Godman and Salvin give a list of the Butterflies collected in Dominica by Mr. G. French Angas. This list contains 27 species, three being described as new, one undetermined, since described by the same authors (P. Z. S. 1896, p. 519), and one treated as identical with a Cuban form through want of material.

In the present paper I am able to add 12 species to the list, three of which are new to science, and to differentiate between the Cuban and Dominican Hesperid.

I am indebted to Messrs. Agar and Allport for the material received.

PYRAMEIS CARDUI.

Papilio cardui Linn. Syst. Nat. i. p. 774.

Two very bad specimens of this cosmopolitan species were obtained.

DIADEMA MISIPPUS.

Papilio misippus Linn. Syst. Nat. i. p. 264.

Messrs. Godman and Salvin record this species. I have only received a single female; it belongs to the form with the white-banded apex, and has a rather faint discal white patch on hind wings above.

MEGALURA PELEUS.

Papilio peleus Sulz. Gesch. Ins. t. 13. f. 4.

Three specimens in bad condition.

AGANISTHOS ORION.

Papilio orion Fabr. Syst. Ent. p. 485.

Three specimens of this common South American species. They agree best with the mainland form, not with that found in the Greater Antilles. In the same way all the specimens of *Anartia jatrophæ* Linn. are typical and do not belong to the variety *saturata* Stgr.

ANÆA DOMINICANA.

Anæa dominicana G. & S. P. Z. S. 1884, p. 316, pl. xxv. f. 1.

Two females. The female differs from the male only in being somewhat larger.

LIBYTHEA FULVESCENS.

Libythea fulvescens Lathy, Abstr. P. Z. S. 1904, No. 5, p. 19, March 22.

Upperside. Fore wing blackish brown, with the following fulvous markings: a wide fascia within cell and two below it, of which the upper is the shorter; a minute spot on middle of costa; two large patches between this and outer margin, the upper being oval in shape, the lower square, and a small oval spot about midway between the latter and outer margin; a minute spot below this. Hind wing with ground-colour paler, especially about inner margin; a discal wide fulvous band, a paler patch midway along costa, and cell suffused with fulvous.

Underside. Fore wing with the fulvous markings all brighter and more extended; outer margin greyish, with brown striations. Hind wing greyish, with brown striations, these becoming dense so as to form a dark patch on costa one-third from the base; a discal band and a wide dark outer margin.

Exp. 50 millim.

In Coll. H. J. Adams, 1 ♂ (type); W. J. Kaye, 1 ♂.

This species may be separated from *L. carinenta* Cram. and *L. motya* Boisd. by the absence of any white markings above; and from *L. terena* Godt. by the greater extent of black above and the unicolorous character of the fulvous markings. Mr. Kaye's specimen differs slightly from the type in having the subapical fulvous spots somewhat diffused.

THECLA SIMÆTHIS.

Papilio simæthis Drury, Ill. Ex. Ent. i. pl. i. f. 3.

A long series.

THECLA SUBOBSCURA.

Thecla subobscura Lathy, Abstr. P. Z. S. 1904, No. 5, p. 19, March 22.

Upperside. Both wings black, inner margin of fore wing and inner marginal half of hind wing shining blue; hind wing with an incipient tail at termination of second median nervule, and a long tail from lower median nervule, this being faintly tipped with white.

Underside. Fore wing blackish grey, paler on inner margin; a transverse obscure dark line beyond cell, angled on lower median nervule and terminating before inner margin; a very obscure dark line between this and outer margin. Hind wing blackish grey, a transverse row of white spots and lines beyond cell, these being inwardly edged with blackish; another row beyond, but very obscure except at anal angle; a bright red patch between middle and lower median nervules, with a black spot on its outer edge, this patch is remote from margin; a black spot at anal angle; a submarginal faint white line becoming obscure towards apex.

Exp. 31 millim.

In Coll. H. J. Adams, 1 ♀.

Allied to *T. vibidia* Hew., but may be distinguished by much darker ground-colour of underside and the larger red patch.

THECLA DOMINICANA.

Thecla dominicana Lathy, Abstr. P. Z. S. 1904, No. 5, p. 19, March 22.

Upperside. Both wings black-brown, the lower basal half of fore wing shining copper-colour; hind wing with faint trace of this on disc, and a minute red spot at anal angle; a minute tail at termination of second median nervule, and a long one from lower median nervule, both tipped with white.

Underside. Fore wing dull greyish brown, a transverse dark line about midway between end of cell and outer margin, this line extends from costa to lower median nervule; a submarginal dark line. Hind wing dull greyish brown; a transverse dark line beyond cell sharply angled at submedian nervure, this line is edged outwardly with white and inwardly with red from costa to second median nervule; an irregular submarginal dark line, and some obscure dark spots close to margin above second median nervule; a triangular black spot on margin between tails, and a round black spot at anal angle, the space between these two black markings bluish grey; the triangular mark has a large reddish

patch on inner side, a very distinct marginal white line from upper tail to anal angle, and a white spot on inner margin near anal angle.

Exp. 23–31 millim.

In Coll. H. J. Adams, 15 ♂ ♂ (type); F. D. Godman, 2 ♂ ♂.

Allied to *T. angelia* Hew. from Cuba, but the smaller amount of copper-colour above and the dark line of hind wings below being partially edged with red at once serve to distinguish it from that species.

THECLA ACIS.

Papilio acis Dru. Ill. Ex. Ent. i. pl. 1. f. 2.

A single specimen in Mr. Kaye's collection.

TERIAS DEVA.

Terias deva Doubld. Gen. D. L. p. 78; G. & S. P. Z. S. 1884, p. 317.

A long series of this species was obtained. The hind wing in both sexes is much more yellow than in specimens from the mainland.

PIERIS MARGARITA.

Mylothris margarita Hübn. Samml. ex. Schmett. ii. pl. cxx.

Four specimens.

CALLIDRYAS AGARITHE.

C. agarithe Boisd. Spec. Gén. i. p. 623.

Messrs. Godman and Salvin received this species but wrongly identified it, recording it under the name of *argante* Fabr. All the specimens received are small, as in the case of those taken by Mr. Angas.

EUDAMUS BREVICAUDATA, sp. nov.

I have given a name to this form, which Messrs. Godman and Salvin treated as *santiago* Luc.? I have had a large number of specimens, and find that the differences these authors point out are quite constant.

PROTEIDES GUNDLACHI.

P. gundlachi Plötz, Stett. ent. Zeit. 1882, p. 91.

The species described as *P. angasi*, sp. nov., in the paper of 1884 by Messrs. Godman and Salvin is synonymous with this.

EPARGYREUS ZESTOS.

Proteides zestos Hübn. Samml. ex. Schmett. p. 24.

A good series.

TELEGONUS ANAUSIS.

T. anausis G. & S. P. Z. S. 1896, p. 519.

Recorded by Messrs. Godman and Salvin in 1884 as *T. anaphus* Cram.

EANTIS PAPINIANUS.

Hesperia papinianus Poey, Cent. Lép. Cuba, 1833.

Several examples.

PRENES NERO.

Hesperia nero Fabr. Syst. Ent. Suppl. p. 433.

Recorded by Messrs. Godman and Salvin as *Pamphila ocola* Edw.

PRENES ARES.

Hesperia ares Feld. Verh. zool.-bot. Ges. Wien, 1862, p. 477.

Several specimens.

April 19, 1904.

Dr. HENRY WOODWARD, F.R.S., Vice-President, in the Chair.

The Secretary read the following report on the additions made to the Society's Menagerie during the month of March 1904:—

The number of registered additions to the Society's Menagerie during the month of March was 133, of which 48 were by presentation, 3 by birth, 17 by purchase, and 65 were received on deposit. The number of departures during the same period, by death and removals, was 134.

Amongst the additions attention may be called to:—

1. A young female Snow-Leopard (*Felis uncia*), from the Pamirs, presented by Capt. Mackintosh on March 9th.

2. Two young female Cheetahs (*Cynælurus jubatus*), from Somaliland, presented by Capt. Barnard on March 2nd.

3. Adult male and female examples of the Nisnas Monkey (*Cercopithecus pyrrhonotus*), from Uganda, presented by Mr. C. R. Hall on March 4th.

4. A Potto (*Perodicticus potto*) and two North-African Crowned Cranes (*Balearica pavonina*), from Lagos, presented by Dr. Macfarlane on March 28th.

Mr. Oldfield Thomas exhibited some skulls of a small North Australian Rock-Wallaby (*Peradorcas concinna* Gould), illustrating the recently discovered fact* that this animal, in common

* Novitates Zoologicæ, xi. p. 226 (1904).

with the Manatee alone of all Mammalia *, had a continuously renewed molar series, fresh teeth growing up and pushing forwards from behind, *pari passu* with the fall of worn-out teeth in front. No evidence was available as to the number of successive teeth produced in the course of the animal's life, but a minimum of seven † molars, that is three more than the normal, was certain.

Mr. Oldfield Thomas also exhibited the skin of a Hartebeest which had been shot by Mr. F. J. Jackson in Uganda, and which appeared to represent a new subspecies of *Bubalis jacksoni*, characterised by its very unusual markings.

It was proposed to be called :—

BUBALIS JACKSONI INSIGNIS‡.

Bubalis jacksoni insignis Thos., Abstr. P. Z. S. 1904, No. 6, p. 22, April 26.

Allied to *B. jacksoni*, but with a black dorsal stripe and black-marked limbs.

General colour tawny, darker than in true *jacksoni*, the hairs tawny throughout, not or scarcely ticked with lighter terminally. Rump, flanks, and under surface lighter tawny, not conspicuously contrasted with the dorsal colour. Centre line of back with a prominent sharply defined black line, about half an inch broad, commencing behind the occiput and running along the spine on to the rump, but ceasing about a foot short of the tail. Head much as in true *jacksoni*, but the tips of the ears edged with black behind, the nasal region darker, and two black marks present on the forehead between the eyes. Ground-colour of limbs of the same light tone as the rump, but their anterior face terminally with strong black markings, very much as in *B. lichtensteini*. On the fore limbs there was a black patch on the knee, the black beginning again lower down and extending to the hoofs; the posterior face of the pasterns, between the accessory and main hoofs, also black. On the hind limbs the black markings ascended from the hoofs about three-fourths the way towards the level of the hock, the back of the pasterns being also black, as on the fore limbs. Tail with the usual black crest on its terminal half, but less developed than in other species.

Fur of back uniformly directed backwards, without any trace of the whorl and reversed hairs on the withers found in *B. jacksoni*.

Skull and horns as in *B. jacksoni*.

Dimensions about as in *B. jacksoni*. Frontal length of skull

* *Cf.* Thos. & Lyd. P. Z. S. 1897, p. 595.

† Notation as in Brit. Mus. Catalogue of Marsupials.

‡ [The first complete account of the new species described in this communication appears here; but as the name and preliminary diagnosis were published in the 'Abstract,' it is distinguished here by being underlined.—EDITOR.]

452 mm.; basal length 410; length of horns on anterior curve 487; basal circumference 273.

Hab. (of type). Maanja River, about 30 miles west of Kampala, towards the Albert Lake, Uganda.

Type. Old Male. Mounted head and skin of body. B. M. No. 4.4.19.1. Presented by Mr. F. J. Jackson. Killed March 1902.

Mr. Jackson had only seen this one specimen, a solitary male, which had possibly wandered out of the normal habitat of its kind. The typical locality of *B. jacksoni* was Northern Kavirondo, but the exact limits of its range were not as yet known, nor the extent to which it graded into the *B. lelwel* of the Upper Nile.

The markings of the present specimen were so striking, and so entirely unmatched within the genus, that, in spite of the nearness of its habitat to that of the true *jacksoni*, Mr. Thomas thought there was no alternative but to give it a distinctive name.

Dr. C. I. Forsyth Major, F.Z.S., exhibited some remains of *Anthracotherium magnum* Cuv. (Plate XXIX.), obtained by Mr. Oldfield Thomas, F.R.S., from a lignite-deposit in Majorca (Balearic Is.), and made the following remarks:—

When Mr. Oldfield Thomas informed me, some years ago, of his intended visit to the Balearic Islands *, I requested him to inquire at the lignite-mines of Majorca after remains of *Anthracotherium* and other mammals, having reasons for supposing that remains of the genus just named had formerly been found there. In the Museo Civico of Milan is, or was, preserved a jaw of *Anthracotherium* of the size of *A. magnum*, with an undoubtedly wrong label attached to it. The late geologist E. Spreafico, to whom I pointed it out many years ago, thought it to be a specimen brought back by Dr. Cristoforo Bellotti from an excursion to the Balearic Islands, and presented to the Museum, but afterwards believed to have been lost in some unaccountable manner.

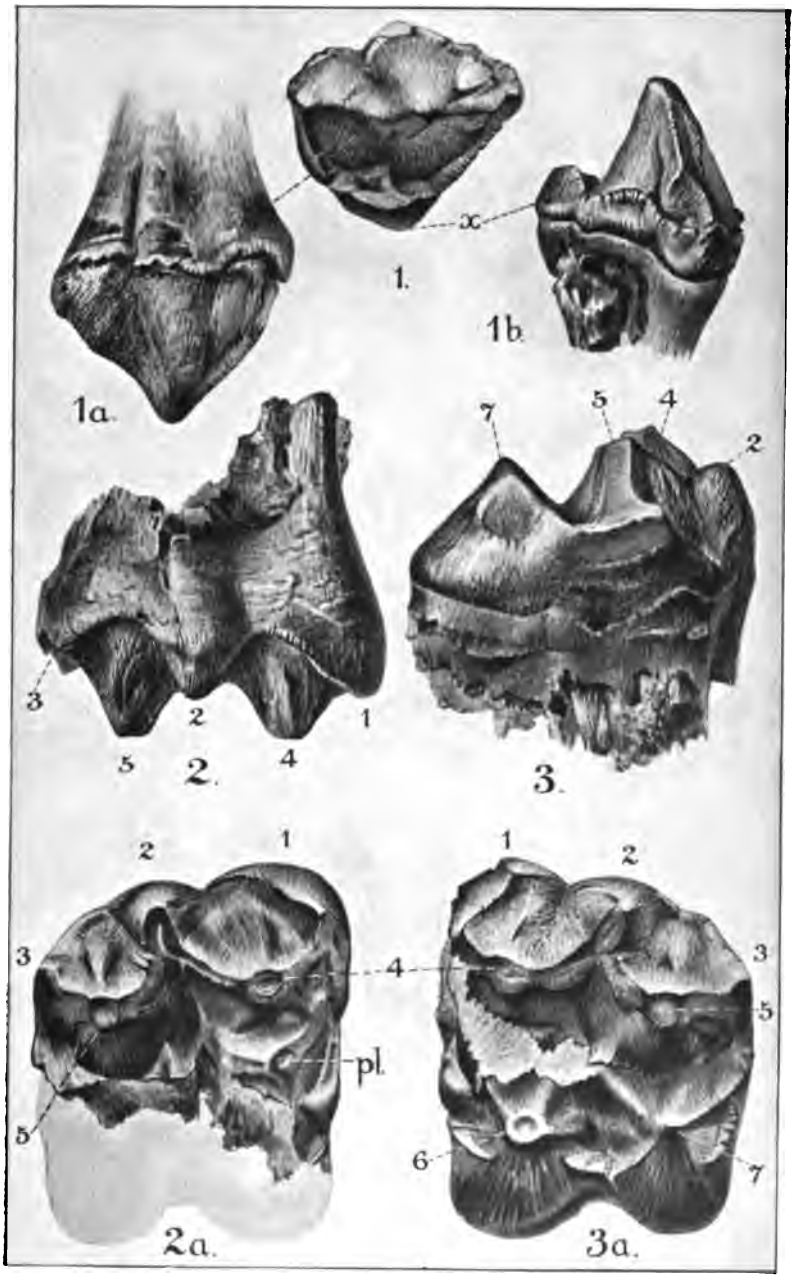
The circumstance, although dating back over thirty years, had not escaped my memory, because I found out afterwards that the lignites in Majorca are generally ascribed to a much older horizon than the one revealed now with certainty by the presence in them of *Anthracotherium magnum*.

The island of Majorca, the largest of the Balearics, was at one time occupied by an immense lake, the longest diameter of which has been estimated at 80 kilometres, almost equalling that of the whole island (92 kilometres) †.

About the geological horizon of this lacustrine formation, con-

* See Oldfield Thomas, "On the Mammals of the Balearic Islands," Proc. Zool. Soc. London, 1901, vol. i. pp. 35–44.

† H. Hermite, "Etudes géologiques sur les îles Baléares," prem. partie, p. 201 (1879).



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ANTHRACOTHERIUM MAGNUM.

taining lignite-deposits in various localities, very different opinions have been held at different times. The Italian geologist General Albert De La Marmora, who was the first to mention the coal, ascribed it to the Lower Cretaceous (Neocomian)*, and was followed in this determination by Bouvy †.

The only writer who correctly guessed the age was Jules Haime, who, from the examination of Molluscs in the lignite deposit, was inclined to assign it to the epoch of the "gypses de Provence," which are of Oligocene age. He was positive in asserting that the coal overlies the Nummulitic formation, adding that this circumstance was well known to the miners themselves ‡.

All the subsequent writers, however—Bouvy §, Vidal ||, Hermite ¶, de Lapparent **—have considered these lacustrine beds to be Lower Eocene, taking it for granted that the Nummulitic (Middle Eocene) overlies the freshwater deposits. This must be either an error of observation, or else the reputed Nummulites were not Nummulites at all.

Mr. Thomas was successful in obtaining, in the house of a miner at Inca, several remains of *Anthracotherium*, which, according to information received, were from the upper part of a lignite-mine at Sineu, Majorca. A complete jaw, believed to be of the same animal, was said to be in the "Academy of Madrid."

The more important of these remains, here exhibited, are two more or less complete right and left second upper molars, and a beautifully preserved penultimate right upper premolar (*p.* 2) (Pl. XXIX. fig. 1). It is on these teeth that the specific determination rests. The molars (Pl. XXIX. figs. 2 & 3) agree perfectly in size and shape with a second upper molar described and figured by G. Cuvier ††, and forming part of one of the type specimens of *Anthracotherium magnum* from the lignite of Cadibona, near Savona (Liguria). The premolar agrees with a similar tooth of the same deposit figured by Gastaldi ‡‡.

A. magnum is the predominant mammalian species in the lignite of Cadibona; there remains little doubt, therefore, that the lacustrine deposit of Majorca is of the same age. The Italian deposit is usually placed in the Upper Oligocene; however, the mammals

* Albert De La Marmora, "Observations géologiques sur les deux îles Baléares, Majorque et Minorque," Mem. R. Accad. Scienze Torino, vol. xxxviii. p. 51 (1835).

† P. Bouvy, "Resena geognostica de la isla de Mallorca y descripcion de la situacion y explotacion de la ulla del terreno secundario de esta isla," Revista Minera, t. iii. pp. 174, 204, 346 (1852). Quoted from Jules Haime's paper.

‡ Jules Haime, "Notice sur la Géologie de l'île Majorque,' Bull. Soc. Géol. de France, (2) xii. pp. 734–752 (1855).

§ Bouvy, "Note sur les Lignites des îles Baléares," Bull. Soc. Géol. de France, (2) xiv. pp. 770–774 (1857).

|| Louis M. Vidal, "Excursion geológica por la Isla de Mallorca," Boletin de la Comision del Mapa Geologico de España, vi. p. 9 (1879).

¶ *Op. cit.* A translation of Hermite's "Études géologiques" has been published in vol. xv. (1888) of the Boletin de la Comision del Mapa Geologico de España.

** A. de Lapparent, 'Traité de Géologie,' fourth edition, p. 1436 (1900).

†† 'Ossemens fossiles,' vol. iii. pp. 399, 400, pl. 80. fig. 1 (1822).

‡‡ Mem. Acc. Scze. Torino, (2) xxiv. pl. vi. fig. 6 (1868).

associated with *A. magnum* at Cadibona, *Gelocus* and *Propalæochœrus*, are somewhat older types. Moreover, the Upper Oligocene deposits of St. Gérand-le-Puy (Allier) contain no Anthracotheres, whereas in the nearly contemporaneous lignites of Pyrimont a more modern type of Anthracotheres than *A. magnum* is represented, viz., *Brachyodus porcinus* (Gerv.)*. These views are confirmed by the latest researches in the geology of the Limagne†, where the deposits containing *Anthracotherium magnum* are referred to the Middle Oligocene (Stampian), even to its lowest portion, so that we shall have to consider as Middle Oligocene also the Lignites of Cadibona and Majorca.

Although remains of *Anthracotherium* are not rare in our collections, the various forms are not very well known, and many fossils have been called *A. magnum* which have little to do with the type species of Cadibona. In this respect also the remains obtained by Mr. O. Thomas increase our knowledge, and this discovery is certainly the most important result of his and Mr. R. I. Pocock's trip to the Balearics.

EXPLANATION OF PLATE XXIX.

Anthracotherium magnum Cuv.

All figures natural size.

Fig. 1. Penultimate right upper premolar, from below. Fig. 1 *a*, external; fig. 1 *b*, anterior view. *x* = inner cusp.

Fig. 2. Incomplete second right upper true molar, external view. Fig. 2 *a*, lower view. *pl.* = anterior intermediate cusp, broken away in specimen fig. 3.

Fig. 3. Second left upper true molar, posterior view. Fig. 3 *a*, lower view.

Mr. F. E. Beddard, F.R.S., exhibited and made remarks upon a series of Avian brains, of which the arterial system had been injected.

The following papers were read :—

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* Ch. Depéret et H. Douxami, "Les Vertébrés oligocènes de Pyrimont-Challonges (Savoie)," Mém. Soc. Paléont. Suisse, xxix. p. 41 (1902).

† J. Giraud, "Etudes géologiques sur la Limagne (Auvergne)," Bull. Serv. Carte Géol. de la France, vol. xiii. no. 87 (1901–1902).

1. On Mammals collected during the Uganda Boundary Commission by the late Mr. W. G. Doggett, and presented to the British Museum by Col. C. Delmé-Radcliffe *.

By OLDFIELD THOMAS, F.R.S., and HAROLD SCHWANN, F.Z.S.

[Received March 11, 1904.]

(Text-figure 95.)

During the delimitation of the boundary between the German and British territories west of the Victoria Nyanza, Col. C. Delmé-Radcliffe, the British Commissioner, has caused collections to be made illustrative of the fauna, and these he has now presented to the National Museum. The actual collecting was done by Mr. W. G. Doggett, who had already acted as zoological collector under Sir Harry Johnston †, and who was carrying on the work in a most successful manner, when he was unhappily drowned by the upsetting of a canoe while in pursuit of fish, so that his death was directly due to his enthusiasm for his Natural History work.

The majority of the animals now described were obtained at Burumba, Ankole, a locality on the Anglo-German boundary, and in a region as yet practically unrepresented in our collections. They form therefore very welcome accessions to the Museum.

Of the novelties special attention may be drawn to the local form of the Buffalo (*Bubalus caffer radcliffei*), already exhibited to the Society ‡, and to the fine striped Stoat which we have named in honour of Mr. Doggett.

1. CERCOPITHECUS ÆTHIOPS CENTRALIS Neum.

♂. 105. ♀. 454. Burumba, Ankole.

Colour of iris russet § (*W. G. D.*).

For geographical reasons we refer these specimens to Mr. Neumann's "*centralis*," without expressing any opinion as to their relation to other members of the group.

2. CERCOCEBUS ATERRIMUS Oudem.

♀. 1; 2. Budzi, Uganda.

3. GALAGO DEMIDOFFI Fisch.

♂. 108. Dumo, Uganda.

* [The complete account of the new species described in this communication appears here; but as the names and preliminary diagnoses were published in the 'Abstract,' such species are distinguished here by being underlined.—EDITOR.]

† *Cf.* P. Z. S. 1901, vol. ii. p. 85. The mammals there described were all collected by Mr. Doggett.

‡ *Supra*, p. 371.

§ The colours of the iris have been shown by a patch of paint placed on the label by Mr. Doggett, and we have determined the shades so given in Ridgway's 'Nomenclature of Colors,' 1886.

4. MEGADERMA FRONS Geoff.

♂. 201; 202. Mulema, Uganda.

5. MACROSCELIDES DELAMEREI Thos.

♂. 109. Demba, Uganda.
♀. 540; 575 (in spirit). Burumba, Ankole.
Colour of iris black (*W. G. D.*).

6. CROCIDURA NYANSÆ Neum.

♂. 468; 511. Burumba, Ankole.

7. PŒCILOGALE DOGGETTI.

Pœcilogale doggetti Thos. & Schw., Abstr. P. Z. S. 1904, No. 6, p. 22, April 26.

♂. 542. ♀. 543. Burumba, Ankole.
Colour of iris clove-brown (*W. G. D.*).

Allied to the southern form, *P. albinucha*, but considerably larger.

General colour and arrangement of stripes as in the type species described by Gray *, but the lateral stripes are longer in proportion to the median one, being fully two-thirds of its length.

Head, neck, and upper half of ears white, passing into "buff-yellow" at the commencement of the median line. Black stripes sharply defined, about 10 mm. broad in the centre of back, tapering off gradually at either extremity. Chin and a patch on the throat dirty white.

Under surface, sides of head, flanks, shoulders, and limbs black. Tail white, the long hairs white to their bases, but close to the skin there is a fine black down which gives the appearance of an indistinct black line down the tail.

Skull conspicuously larger and more strongly built than in *P. albinucha*, but apparently similar in form. The male skull much larger than the female.

Dimensions of the type (measured in the flesh):—
Head and body 356 mm.; tail 242; hind foot 46; ear 25.
Comparative skull-measurements:—

	P. doggetti.		*P. albinucha*.
	♂ (type).	♀.	♂.
	mm.	mm.	mm.
Greatest length	60·5	55·5	51·4
Basal „	58·0	52·0	48·0
Zygomatic breadth	33·5	31·0	28·5
Mastoid „	31·4	27·0	25·0
Interorbital „	11·5	9·2	9·0
Palate length	27·4	24·3	23·0
Length of upper carnassial ...	6·6	6·2	6·2
„ lower „ ...	6·5	6·2	6·2

* P. Z. S. 1864, p. 69.

Hab. Burumba, Ankole.

Type. Male. B. M. No. 4.2.6.7. Original No. 542. Collected September 1903.

8. LUTRA CAPENSIS Schinz.

♀. 4. Victoria Nyanza.

9. HERPESTES GALERA ROBUSTUS Gray.

♀ (in spirit). Burumba, Ankole.

10. HELOGALE UNDULATA Peters.

♂. 641. ♀. 573; 574 (in spirit). Burumba, Ankole.
Colour of iris "tawny olive" (*W. G. D.*).

11. SCIURUS RUFOBRACHIATUS NYANSÆ Neum.

♀. 88. Msozi.

12. GRAPHIURUS MURINUS Desm.

♂. 514. Burumba, Ankole.
Colour of iris "seal-brown" (*W. G. D.*).

Herr Neumann has given the varietal name of *subrufus* * to a Dormouse of this group from Tanga, on the coast opposite Pemba, but its character, a strong reddish suffusion on the chest, is one often due to a glandular staining of the hairs and may be found in examples from all localities. A. Smith's *Myoxus erythrobronchus*" † was founded on a similar aberration.

13. TATERA FALLAX.

Tatera fallax Thos. & Schw., Abstr. P. Z. S. 1904, No. 6, p. 22, April 26.

♂. 502 (juv.). ♀. 512; 513. Burumba, Ankole.
Colour of iris black (*W. G. D.*).

A large *Tatera* with a white-tipped tail and indistinct grooves on the upper incisors.

General colour above dark sandy, brighter on the sides, where it is almost "ochraceous buff." Individual hairs of back about 15 mm. in length, slate-gray for their basal half, buff-yellow subterminally, with a black tip. Under surface dull white, sharply defined; the hairs white to their bases. Top of head like back; muzzle and forehead rather darker; area between eye and ear whitish, with a dark patch below. Ears slightly larger than is usual in this group; dark, nearly naked, with a white patch at their posterior bases. Upper and outer surfaces of fore limbs buffy yellow; fore and hind feet pure white. Tail considerably longer than the head and body; its proximal half indistinctly bicolor, pale brown above, white below; distal half white throughout; tip not tufted.

Skull strongly built, larger than in any of the allied species.

* Zool. Jahrb. Syst. xiii. p. 547 (1900).
† Zool. Journ. vol. iv. p. 438.

Bullæ unusually large. Upper incisors each with one indistinct median groove.

Dimensions of the type (measured in the flesh):—

Head and body 160 mm.; tail 219; hind foot 43; ear 24.

Skull: greatest length 45 mm.; basal length 36; zygomatic breadth 24; brain-case, breadth 18; interorbital breadth 7; nasals 19·4 × 3·5; diastema 12·3; length of palatine foramina 8·8; length of bulla 12; upper molar series 7.

Hab. Burumba, Ankole. Alt. 5000 feet.

Type. Female. B. M. No. 4.2.6.13. Original No. 513. Collected August 1903.

This distinct species appears to be allied to *T. valida* Boc. and *T. liodon* Thos., sharing with them the unusual shallowness of the incisive grooves *, but it is easily separable by its much larger skull and white-tipped tail.

Externally it has a close resemblance to *Gerbilliscus boehmi* Noack, to which Dr. Matschie appears to have referred it †, but its single incisive groove and much larger bullæ readily distinguish it from that animal.

14. Otomys irroratus tropicalis Thos.

♀. 458. Burumba, Ankole.
Colour of iris black (*W. G. D.*).

15. Lophuromys aquilus True.

♂ (in spirit). Burumba, Ankole.

16. Arvicanthis abyssinicus Rüpp.

♂. 515. ♀. 455; 456; 457. Burumba, Ankole.
Colour of iris black (*W. G. D.*).

17. Tachyoryctes splendens ibeanus Thos.

♂. 461; 462; 463; 464; 503; 504; 507; 508. ♀. 465; 505; 506; 509. Burumba, Ankole.
Three specimens in spirit and several skeletons.
Colour of iris "seal-brown" (*W. G. D.*).

18. Lepus crawshayi de Wint.

♀. 544. Burumba, Ankole.
Colour of iris raw umber (*W. G. D.*).

19. Procavia stuhlmanni Matsch.

♂. 510. ♀. 469; 470. Burumba, Ankole.
♂ and ♀ in spirit.
Colour of iris black (*W. G. D.*).

These specimens have enabled us to make the interesting discovery that there is a third mammary formula found in the

* See Thos. Ann. & Mag. N. H. (7) ix. p. 442 (1902).
† Säug. Deutsch-Ost-Afrika, p. 54 (1895). Specimen from Bukoba, Victoria Nyanza.

group besides those already recorded. The typical Procaviæ of the hypsodont section have 1—2 = 6 mammæ, while the Dendrohyrax section were supposed to have in all cases only 0—1 = 2 mammæ. Now, however, we find that the two adult females of the present series (one of them in spirit) have a pectoral pair of mammæ combined with a single inguinal pair, the formula being therefore 1—1 = 4.

On communicating with Dr. Matschie, the describer of *P. stuhlmanni*, he informs us not only that a fresh examination of the typical series confirms our numeration of the mammæ, but also that the same formula obtains in *P. arborea* and *P. scheelei*, while his *P. neumanni* has the more usual 0—1 = 2.

Of other species recently described, *P. crawshayi* Thos. has 0—1 = 2 mammæ, while the large woolly-haired *P. ruwenzorii* Neumann * has again 1—1 = 4.

Now that representative specimens of *P. stuhlmanni* are available for comparison, we are enabled to describe as new the following Dassie, which had hitherto been provisionally assigned to Dr. Matschie's species :—

PROCAVIA BETTONI.

Procavia bettoni Thos. & Schw., Abstr. P. Z. S. 1904, No. 6, p. 23, April 26.

Most closely allied to *P. stuhlmanni*, but darker coloured and smaller.

Fur long, soft and fine, not woolly; hairs of back about 33 mm. in length, intermixed with longer bristles. General colour above pale drab-brown, washed with a warmer tone along the dorsal area. Individual hairs dark chocolate-brown, darkening to black for their basal seven-eighths, ringed with pale drab subterminally and tipped with black. Face brown, a spot on each eye whitish. Ears thickly haired, brown outside, white internally. Lips white. Chin brown, throat drabby white; rest of under surface and inner side of limbs creamy white, the hairs white to their bases. Outer side of limbs like body; hands and feet pale buffy. Dorsal spot small, oval, its hairs wholly pale yellowish white.

Skull, as compared with that of *P. stuhlmanni*, markedly smaller, the type, in stage V, smaller than that of a *P. stuhlmanni* in stage IV. Nasals small, with less projection over the nasal opening. Orbits not closed in behind, though the processes approach each other closely. Interparietal sutures, in stage V, closed behind but open in front, as is also the case in *P. stuhlmanni*, but the breadth of the interparietal appears to be greater in the new form, and its anterior edge, instead of being strongly arched forward, is nearly directly transverse. Posterior nares very narrow. Molars conspicuously smaller in all dimensions than in *P. stuhlmanni*.

* P. Z. S. 1902, ii. p. 143.

Dimensions of the type, measured in skin :—

Head and body (c.) 400 mm.; hind foot 50.

Skull (stage V): greatest length 81 mm.; basal length 75·5; zygomatic breadth 45; nasals 18 × 16·5; diastema 13·5; combined length of four premolars and two anterior molars 26·7; breadth of m^1 5·1; length of anterior lower premolar 3·3.

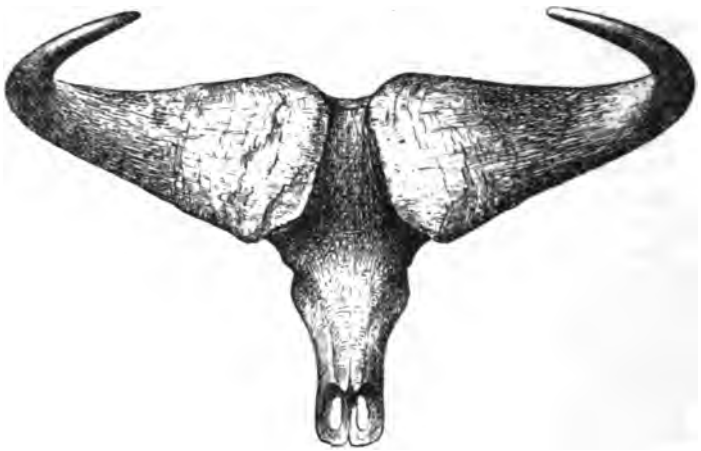
Hab. Rogoro, Kikuyu (Mile 346 of Uganda Railway), British East Africa.

Type. Male. B. M. No. 0.1.3.5. Collected 24 June 1899 and presented by Mr. C. S. Betton.

20. BUBALUS CAFFER RADCLIFFEI Thos., Abstr. P. Z. S. 1904, No. 4, p. 13, March 1; P. Z. S. 1904, vol. i. p. 371.

Five skulls, three males and two females. Burumba, Ankole.

Text-fig. 95.



Skull and horns of *Bubalus caffer radcliffei*.

The description of this fine Buffalo has been already published (*ll. cc.*); we now give a figure of the typical skull*.

21. EGOCERUS EQUINUS LANGHELDI Matsch.

♂. 593; 594.

Colour of iris walnut-brown (*W. G. D.*).

This animal was described on the same day (Nov. 15, 1898) by Dr. Matschie in Berlin as *Hippotragus langheldi* †, and by Dr. O. Neumann in London as *H. rufopallidus* ‡. Fortunately, however,

* Some imperfect skins, presumably of *B. c. radcliffei*, have since arrived. They are uniformly black, and are remarkable for the unusual number of the hair-whorls upon the shoulders and haunches (May 9, 1904).

† SB. Ges. naturf. Fr. Berlin 1898, p. 181.

‡ P. Z. S. 1898, p. 850.

there is no doubt as to which name should stand, for since no diagnosis was given by Herr Neumann in the Abstract (as published in 'Nature' and elsewhere), the delay in the issue of the November part of the 'Proceedings' until April 1, 1899, allowed abundant time for the German 'Sitzungsberichte' to be published.

With regard to the generic name now used, it may be pointed out that *Hippotragus* (Sundevall, 1846 *) is antedated by *Ozanna* (Reichenbach, 1845), and that the latter name should be used by those who contend that *Egocerus* (Desmarest, 1822) is invalidated by *Ægoceros* (Pallas, 1811).

But since the last-mentioned term is not in use, being a synonym of *Ovis*, and the alternative to *Egocerus* is the very objectionable name *Ozanna*, we are of opinion that this is one of the cases where a name need not be considered preoccupied unless its spelling is identical with that of its earlier rival.

2. Contributions to the Anatomy of the Lacertilia.—(2) On some Points in the Structure of *Tupinambis*. By Frank E. Beddard, F.R.S., Prosector to the Society.

[Received March 14, 1904.]

(Text-figures 96–98.)

The principal recent memoirs known to me which deal with the visceral anatomy of *Tupinambis* are those of Butler †, Hochstetter ‡, and Milani §. The two former deal almost entirely with the diaphragm, whilst the last-mentioned author describes the lungs and refers to previous observations (those of Meckel) upon the same organs. I myself deal in the following pages with a few anatomical facts which, so far as I am aware, are new.

Aortic trunk.—The heart of *Tupinambis* resembles that of *Iguana* more than that of *Tiliqua* in its closeness to the liver. Moreover, the right and left aortæ trace a longer course before they join to form the common aorta. There are, in fact, in *Tupinambis* and *Iguana* three pairs of intercostals arising from the right aortic arch between the origin of the subclavian and the fusion of the aortæ, while there are only two pairs in *Tiliqua*. In the last-named genus the subclavians are concealed beneath the musculature for a considerable distance after their origin from the aorta; in *Tupinambis*, as in *Iguana*, these vessels are superficial and visible from their origin until where they plunge into

* References to all these names will be found in Palmer's invaluable 'Index Generum Mammalium,' 1904.

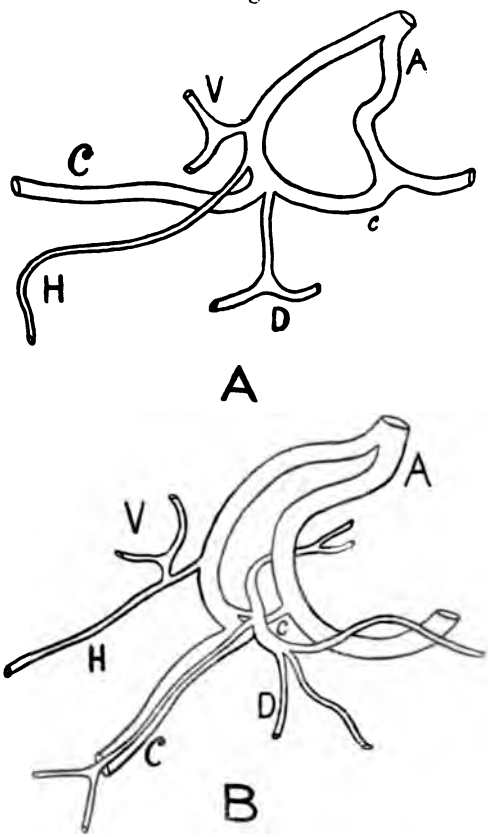
† "On the Subdivision of the Body-cavity in Lizards, Crocodiles, and Birds," P. Z. S. 1889, p. 452.

‡ "Ueber partielle und totale Scheidewandbildung, &c.," Morph. Jahrb. xxvii. 1899, p. 263.

§ "Beiträge zur Kenntniss der Reptilienlungen," Zool. Jahrb., Anat. Heft vii. p. 545.

the muscles of the fore limb. In both *Tupinambis* and *Tiliqua* the aortic arches and their branches can be plainly seen from the interior of the body-cavity. In *Iguana*, on the other hand, the branching of the carotid takes place partly in the thickness of the parietes owing to the narrowness of the "chest" of this Lizard. There are, moreover, slight differences in these branches, as is to be seen in the annexed drawing (text-fig. 96).

Text-fig. 96.



A.—Right carotid and aorta of *Tupinambis nigropunctatus*.
B.—Ditto of *Iguana tuberculata*.

A, aorta; *c*, connection with carotid; C, carotid; D, branch of carotid to dorsal musculature; H, lingual artery; V, branch of carotid (or lingual) to ventral musculature.

The ductus botalli between the carotid and the aorta is distinctly larger in *Tupinambis*, as is also the branch of the carotid which supplies the dorsal musculature of the neck and shoulder. The latter

branch in *Iguana* arises further back upon the carotid stem and has a shorter course before dividing into its several branches.

The Lungs and their attachment.—Mr. G. W. Butler* has pointed out that "the Teiidæ are the only family in which I have met with the condition in which the lung of each side is suspended freely by its more dorsal ligament, with a consequent absence of pulmo-hepatic recess." † In an accompanying diagram the absence of any pulmo-hepatic ligament is shown and contrasted with its presence in such a type as *Iguana*. As a matter of fact, *Tiliqua scincoides* agrees with *Tupinambis* in the free suspension of the right lung; but in both of them the difference from *Iguana* &c. is only a difference of degree. In both of the former genera there is a short membrane attaching the right lung to the anterior part of the liver; it is obvious, though rudimentary. A difference which *Tupinambis* shows from some other types in the attachment of the right pulmonary membrane is this: in the Teguexin the suspensory ligament is attached up to the very tip of the lung and extends considerably beyond the lung, ending, as it does, upon the posthepatic septum. Anteriorly the membrane is attached to the hepato-œsophageal ligament; it is then attached to the œsophagus at its dorsal border and so continues to the end. In *Tiliqua* the pulmonary ligament does not extend to the tip of the lung; it is inserted at first on to the œsophagus, and more posteriorly, where the œsophagus bends to the left, to the ligament, continuous with the hepato-œsophageal ligament, which binds the liver to the mid-line of the dorsal parietes. On the left side the pulmonary ligament again extends to the very tip of the lung in *Tupinambis*. The membrane is attached first to the gastro-hepatic ligament; it then becomes inserted on the stomach and is continued backwards through the large foramen in the posthepatic septum on the left side, whence it may be traced as far as the spleen and the left gonad. The spleen and the left gonad, it may be remarked, lie much closer together in this lizard than they do in either *Iguana* or *Tiliqua*. In the two latter genera the pulmonary ligament of the left lung does not quite reach the end of that viscus; moreover, from the very first there is an attachment to the œsophagus, a separate fold of membrane in both these types binding the left lung to the gastro-hepatic ligament. Posteriorly the left pulmonary ligament may be observed to reach the spleen but *not* the gonad.

The Liver, its Suspensory Ligaments and Veins.—The liver of this reptile is figured by Butler ‡ in several aspects; but the shape of the liver in the example studied by myself is not quite identical. It must be borne in mind, however, that we are dealing with different species. The falciform ligament suddenly bends to the left and lies in a cleft of the left lobe of the liver into which enters

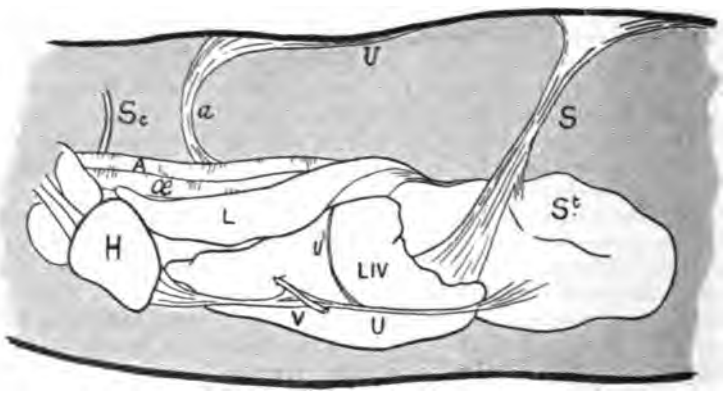
* *Loc. cit.* p. 486.

† Later, however (P. Z. S. 1892, p. 481), he finds that certain skinks agree with the Teiidæ more or less.

‡ *Loc. cit.* pl. xlviii. figs. 31, 33, 34.

the median epigastric vein; the cleft runs obliquely forward a little further than the point where the reflexed falciform ligament ends. The left lobe of the liver is furthermore marked by a longitudinal furrow extending nearly as far forward as a transverse seam running across the liver. This seam supports a very short and delicate membrane which does not reach the ventral parietes. It is figured by Butler as running obliquely, which is not the case in my specimen. Butler does not discuss the homology of this membrane. It seems to me to be a vestige of the left half of the double falciform ligament that occurs in *Sepa* and *Tiliqua*. The liver as a whole is considerably narrower than that of either *Iguana* or *Varanus*. The prolongation along the vena cava of the lateral lobe of the right liver perforates the "diaphragm." The falciform ligament of the liver is single save for the rudiment of the left ligament already referred to. Posteriorly it is continuous with the posthepatic septum. Anteriorly it can be seen (see text-fig. 97) to be continuous with a fold of membrane,

Text-fig. 97.



Dissection of thoracic cavity of *Tupinambis nigropunctatus*, to show relations of prehepatic and posthepatic septa.

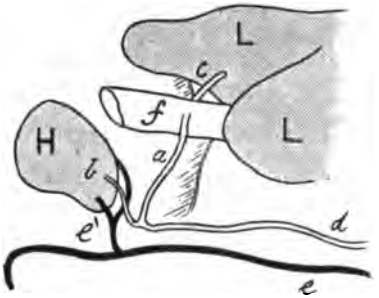
A, aorta; *a*, prehepatic septum continuous with falciform or umbilical ligament; *H*, ventricle of heart; *L*, left lung; *Liv*, liver; *œ*, œsophagus; *S*, posthepatic septum; *Sc*, subclavian artery of left side; *St*, stomach; *U*, falciform or umbilical ligament which has been cut longitudinally and the liver pushed to the right. The thick black line represents the line of the ventral parietes cut longitudinally to the right of the attachment of the umbilical ligament; U^1, rudimentary left umbilical ligament; *V*, median epigastric vein.

especially well developed on the left side of the body, which curves upwards and reaches the middle dorsal line of the parietes. This lies well behind the heart and at the level of about the middle of the lung. In its course it curves backwards both dorsally and ventrally, and its line of attachment to the parietes is therefore convex anteriorly.

This septum, furthermore, lies well behind the artery and vein supplying the fore limb. It cannot, therefore, be confused with the transverse membrane found in this and other Lizards running from the base of the heart and other parietes in front of the vessels which supply the fore limb.

This anterior transverse septum carries in the neighbourhood of the liver the two epigastric veins, which differ in some particulars from those of other Lizards. As is shown in the accompanying drawing (text-fig. 98), the two epigastric veins, right and left, join

Text-fig. 98.



Epigastric vein of *Tupinambis nigropunctatus*.

a, median vessel formed by junction of two epigastric veins; *b*, branch running along gubernaculum cordis to heart; *c*, branch from liver to vena cava; *d*, epigastric trunk; *e*, epigastric artery; *e'*, its branch to heart; *f*, vena cava; H, heart; L, liver.

to form a common trunk, which opens into the vena cava close to its emergence from the liver. Exactly opposite to the point of entrance of the conjoined epigastrics a small vein from the liver enters the vena cava. This vein is of the same calibre as the epigastric, and the two are exactly in the same straight line. I cannot but think that what has happened here is that the conjoined epigastrics have secondarily acquired an opening into the vena cava, and that they were originally, as in other Lizards, directly connected with the hepatic portal system. Posteriorly, as in other Lizards, the two epigastric veins reach the two halves of the anterior abdominal. The heart of this lizard, as is generally but not universally the case among Lizards, is tied down to the pericardium by a gubernaculum cordis. Along this run to the walls of the heart a small vein, which is a branch of the two epigastric veins just where they join, and an arterial branch from each of the epigastric arteries which run down the body-wall in close proximity to the epigastric veins. Another epigastric artery accompanies the anterior abdominal vein. It is double in the region of the liver; but further back the two arteries fuse to form one.

The liver in this Lizard has only one gastro-hepatic vein, which

runs across the gastro-hepatic ligament at a point about opposite to the entrance of the median epigastric vein, which latter has already been referred to.

The remaining structural features to which I call attention are only two. As in *Tiliqua**, the meso-rectum divides the two venæ renales revehentes from each other.

The position of the kidneys resembles that of *Varanus* rather than *Tiliqua* or *Iguana*, inasmuch as they are not hidden by the pelvic bones.

3. On the Characters and Affinities of the Triassic Reptile *Telerpeton elginense*. By G. A. Boulenger, F.R.S., V.P.Z.S.

[Received March 22, 1904.]

(Plates XXX.–XXXII.† and Text-figure 99.)

Of all the principal types of Reptiles the fossil remains of which have yet come to light, no one stood in more urgent need of re-investigation than the little 'Saurian' from the Trias of Elgin, first described by Mantell in 1852 under the name of *Telerpeton elginense*‡. Notwithstanding the detailed description of a more perfect specimen entrusted to Huxley by the late Mr. James Grant some years later §, it was impossible, from the data available, to form any opinion as to the position in the system of the genus *Telerpeton*, which by later writers is referred, with doubt, either to the Rhynchocephalia or to the Lacertilia ‖.

Fortunately for the elucidation of this question, further specimens have been obtained at Lossiemouth during the last few years by my friend Mr. William Taylor, in whose hands the specimen described by Huxley had also fallen after the death of Mr. James Grant, and I gladly availed myself of his kind offer to look over this material, consisting of the following specimens:—

A (Plate XXXII.).—A nearly complete specimen, the bones mostly represented by casts, the original bony substance having disappeared, in a block of sandstone from Lossiemouth broken irregularly into five pieces. The reptile must have measured about 240 millimetres (skull, 45). As observed by Huxley, who gave a description of this specimen, the body is curved towards the right side, and the head and neck are bent dorsad in a plane different from that of the skull. Wax and gutta-percha casts have now been made for me by Mr. Hall, which render the outlines of some of the bones much clearer, and which enable

* Beddard, "Contributions to the Anatomy of the Lacertilia.—(1) On the Venous System in certain Lizards," P. Z. S. 1904, vol. i. p. 436.

† For explanation of the Plates, see p. 481.

‡ Quart. Journ. Geol. Soc. viii. 1852, p. 100, pt. iv.

§ *Op. cit.* xxiii. 1867, p. 77, figs.

‖ Lydekker, Cat. Foss. Rept. i. p. 294 (1888); Zittel, Handb. Pal. iii. p. 597 (1889); F. von Huene, Pal. Abh. x. 1902, p. 8; Broom, Rec. Albany Mus. i. 1903, p. 1.

TELERPETON ELGINENSE.

1

3

2

1, 2. TELERPETON ELGINENSE. 3. PROCOLOPHON TRIGONICEPS.

THERETON ELGINENSE.

me to supplement and correct the original description. Further information might doubtless be obtained by developing some parts of the fossil—the region of the shoulder-girdle for instance; but from the great historical interest which attaches to the specimen, it was deemed advisable to preserve the condition in which it left the hands of its original describer.

B (Plates XXX. & XXXI. fig. 1).—A nearly complete specimen, minus the tail, from the East Quarry, Lossiemouth, found in 1898, in two slabs. This specimen, lying perfectly flat in the sandstone block, with very little distortion, is important as showing the general proportions, and the exact shape of the skull as seen from above. Part of the left fore limb is exposed, and by chiselling the matrix both hind limbs were brought to light, without the feet unfortunately, the block terminating in a line with the base of the tail. Much of the bone is preserved in this fossil, but in a very friable condition. The skull measures 50 millim. in length, and the præcaudal vertebral column 13.

C (Plate XXXI. fig. 2).—An imperfect skull, much stained by oxide of iron, showing the left orbit, the greater part of the fronto-parietal region, of which very little of the osseous substance is left, and the pulp-cavities of most of the upper teeth. This very important specimen was obtained in the West Quarry at Lossiemouth in 1902.

These three specimens have now come into the possession of the Geological Department of the British Museum, and have kindly been placed at my disposal for study by Dr. A. Smith Woodward, who has besides granted me the valuable services of the excellent preparator, Mr. Richard Hall, by whose skill specimen B has been further developed. And in order that I should have before me all the material known to exist at present, Dr. Traquair consented to send on loan to the British Museum the type specimen of *Telerpeton elginense* now in the Museum of Science and Art, Edinburgh *.

I beg to express my sincere thanks to Mr. Taylor, to Dr. A. S. Woodward, to Dr. Traquair, and to Mr. Hall for having enabled me to prepare the account now published.

A rapid first inspection of the new material showed that the skull was characterised by enormous orbits, bordered behind by a narrow, imperforate supratemporal roof, a very large pineal foramen, and transversely enlarged, bilobate lateral teeth, characters which at once suggested to my mind special affinity with the South-African Permo-Triassic *Procolophon* (Plate XXXI. fig. 3), whilst the dentition at the same time recalled the figures given

* The statement in the British Museum Catalogue of Fossil Reptiles, i. p. 295, that this type is preserved in the Museum at Elgin is the result of misinformation. It formed part of the Powrie Collection, which was acquired for the Edinburgh Museum in 1891.

by Cope of *Diadectes* and *Empedias*, from the Upper Permian of Texas. It will be shown hereafter that a detailed study has substantiated this first impression, and that *Telerpeton*, far from being related to either the Rhynchocephalia or Lacertilia, is to be assigned to the Order Cotylosauria, established by Cope for *Diadectes*, and which would include also *Procolophon*. The representative of another order is thus added to the varied reptile fauna of the Elgin sandstones *.

The Skull.

Huxley regarded *Telerpeton* as a true Lacertilian †, and this opinion evidently influenced him in the restoration of the lateral aspect of the skull, given in outline on p. 78 of his paper.

In the light of the specimens now available and of our present knowledge of fossil Reptiles, the faults of this restoration are seen to lie in the omission of the temporal roof, the part identified as a free quadrate being merely an impression of the inner side of the quadrato-jugal, a break in the stone having been taken for a

* Until 1844, no remains of animals other than bones and teeth of fishes, which proved to be of Old Red Sandstone [Devonian] age, were known from the Elgin sandstones. In that year Patrick Duff discovered scutes near Lossiemouth which, after having been described as of a Devonian fish, were shown by Huxley to have pertained to a Triassic Parasuchian Reptile—*Stagonolepis robertsoni*. Shortly after, Patrick Duff discovered in Spynie Quarry the little reptile which was described as *Telerpeton elginense*. Other types were successively brought to light, establishing beyond question the Triassic age of the beds, however great the difficulty of distinguishing them from the underlying Old Red. Mr. Taylor has kindly furnished me with a list of the localities which have yielded the principal Reptilian remains :—

I. Stagonolepis beds.—Fine-grained sandstones without pebbles; bones nearly always preserved.

Findrassie Quarry	*Stagonolepis robertsoni* Agassiz. *Dasygnathus longidens* Huxley.
Spynie Quarry	*Stagonolepis robertsoni* Agass. *Ornithosuchus woodwardi* E. T. Newton. *Hyperodapedon gordoni* Huxley. *Telerpeton elginense* Mantell.
Lossiemouth Quarries	*Stagonolepis robertsoni* Agass. *Ornithosuchus woodwardi* E. T. Newt. *Erpetosuchus grasti* E. T. Newt. *Stenometopon taylori* Boulenger. *Hyperodapedon gordoni* Huxley. *Telerpeton elginense* Mantell.

II. Gordonia beds.—Rough-grained sandstones with pebbles; bones never preserved, only casts being found.

Cutties Hillock Quarry	*Gordonia traquairi* E. T. Newt. „ *huxleyana* E. T. Newt. „ *duffiana* E. T. Newt. „ *juddiana* E. T. Newt. *Geikia elginensis* E. T. Newt. *Elginia mirabilis* E. T. Newt.

For the position of these quarries, *cf.* a map given by Dr. G. Gordon in Trans. Geol. Soc. Edinb. vi. 1893, pl. x.

† "It is Saurian in all its characters; and if we enquire to which division of the Sauria *Telerpeton* belongs there appears to be no doubt that it must be referred to the true *Lacertilia*, and among them to the suborder *Kionocrania* of Stannius, which contains all the modern Lizards—though I cannot make sure, from the present specimen, that it possessed a columella."—Huxley, *l. c.* p. 83.

suture between 'squamosal' and 'quadrate,' and in the exaggerated length of the anterior mandibular tooth, owing to the root being made to project beyond the bone, the thecodont nature of the Reptile not having been recognised. As to the side teeth, Huxley only described them from their lateral aspect, without mentioning that on the right side of the specimen the fourth maxillary tooth may distinctly be seen, in a transverse section, to have been transversely expanded and molar-like.

The skull is seen on Mr. Taylor's specimen (B) from the East Quarry, Lossiemouth, to have been much depressed, about as long as broad, obtusely pointed in front, with enormous pear-shaped orbits separated from the posterior border by a narrow supratemporal roof; these orbits are twice as long as broad, and twice as broad as the least interorbital width, which equals the least width of the supratemporal roof. The nasal bones are large, subtriangular, and the nostrils nearly terminal. All the bones are paired, and the sagittal suture is interrupted by a very large, round pineal foramen, which, instead of being bordered entirely by the parietal bones, as in *Procolophon*, is situated between the frontals and the parietals. The posterior part of the upper surface of the skull and the interorbital region are also well shown by the imperfect skull, C. The posterior outline of the skull is strikingly as in *Procolophon*, there being a shallow notch in the posterior border on each side, and the supratemporal (*epiotic* of Seeley, *squamosal* of A. S. Woodward) forming a pointed process above the deep lateral notch which probably formed the border of the large auricular meatus. No vacuity could be detected representing a latero-temporal fossa. The annexed restoration of the upper surface of the skull is based on Mr. Taylor's two specimens, some of the sutures, in dotted lines, being hypothetical.

An accident to specimen B, in the course of preparation, has resulted in the fortunate exposure of a part of the dorsal aspect of the palate, which is seen to have been extremely similar to that of *Procolophon*, at least so far as the basisphenoid and the pterygoids are concerned, but the vacuity between these three bones was broader than long, instead of longer than broad. I can see no trace of a parasphenoid, any more than in the specimen of *Procolophon* described by Seeley *.

Each maxillary bore six large bilobate teeth, the roots hourglass-shaped in horizontal section, their transverse diameter at least double the longitudinal, and with large pulp-cavities; the teeth were implanted in sockets, not acrodont as believed by Huxley. Three conical teeth were present in each præmaxillary, the first the largest. The circular roots of a few vomerine teeth are visible in specimen C.

The dentition therefore bears a close resemblance to that of

* On the skull of *Procolophon*, *cf.* Seeley, Phil. Trans. clxxx. B, 1889, p. 269, pl. ix.; A. S. Woodward, Vert. Palæont. p. 148, fig. (1898); Broom, Rec. Albany Mus. i. 1908, p. 9.

Procolophon *, differing, however, in the molar teeth being wider still, in this respect agreeing with *Diadectes* and *Empedias*, as figured by Cope †.

THE VERTEBRAL COLUMN.

I have very little to add to our previous knowledge of the vertebral column. Having had gutta-percha and wax impressions made of the specimen described by Huxley, and also from examination of the type specimen, I can state that intercentra were absent between the dorsal vertebræ, that these were rather strongly biconcave, and that transverse processes did not exist. The number of præsacral vertebræ in specimen B was twenty. The long and slender præsacral ribs were but slightly thickened at the base.

The length of the tail is still unknown; but it was probably not much longer than in the type specimen figured by Mantell.

THE PECTORAL ARCH.

This was inserted immediately behind the skull, as in the Stegocephala, *Pariosaurus*, *Procolophon*, and *Sclerosaurus* ‡.

Although the fossils at hand do not show the characteristic T-shaped interclavicle, I have no doubt the shoulder-girdle agreed essentially with that of *Procolophon*. This part of the skeleton is best shown by Huxley's specimen. But for the anterior expansion of the glenoid cavity, which seems to me doubtful, the scapula has left a cast which agrees well with Huxley's restoration. But the latter is to a great extent fanciful as regards the coracoid, part of which, it is true, is indicated in the figure § by a dotted line. The large fenestra does not appear to have existed, its supposed presence being due to matrix which, I think, could be easily removed were it not that the historical interest attaching to the specimen precludes its further development. The important point, overlooked by Huxley, is the presence of a straight transverse suture, extending from the glenoid cavity, which divides the bone into two, the præcoracoid and the coracoid, the former being only a trifle shorter than the latter. Cleithra were certainly not present.

THE PELVIC ARCH.

This has been described very shortly by Huxley, and the outline figure given by him indicates a very Lacertilian state of things. I agree with his representation of the ilium, but I am convinced that the supposed impressions of the pubis and ischium

* *Cf.* Pl. XXXI. fig. 3.

† Proc. Amer. Philos. Soc. xix. 1881, pl. v.

‡ The restorations of *Sclerosaurus* by von Huene, Geol. Pal. Abh. x. 1902, p. 29, and of *Pariosaurus* by Broom, Ann. S. Afr. Mus. iv. 1903, pl. xvi., appear to me both incorrect in representing these reptiles with a distinct neck. Fossils *in situ* show the clavicular arch to have been under the anteriormost cervical vertebræ. These reptiles had no more neck than a Salamander.

§ *Loc. cit.* p. 78.

are a fallacy, as I have satisfied myself that the two bones have left perfectly defined impressions on the counterpart of the fossil from which Huxley drew up his description and diagram. A figure is given of this impression, or rather of a gutta-percha cast of it*, by which it will be seen that, as we now know to be the case in *Procolophon* † and in Triassic Rhynchocephalians, Plesiosaurians, and Ichthyosaurians, the pubis and ischium were plate-like; these two bones were in contact with each other and with their fellows, whilst the former was pierced by a foramen near the antero-external side, this foramen appearing as a knob-like elevation of the sandstone on the fossil, and most distinctly on the wax and gutta-percha impressions taken for me by Mr. Hall. Both the bones were thickened on their acetabular border and at the symphysis; the outer border of the ischium was strongly notched, the greatest width being at the line of the acetabulum; the length of the ischium was once and three-fifths that of the pubis. I may add that a perfectly distinct impression of the pelvis as here described may be seen on the type specimen ‡.

The position of the ilium on Huxley's specimen shows it to have slanted slightly backwards from the sacrum to the acetabulum, and that of the pubis and ischium also indicates the iliosacral attachment to have been præacetabular, although to a but slight extent by no means comparable to that reached by *Pariosaurus* §.

The Limbs.

I have a little to add to the information to be gathered from Mantell's and Huxley's descriptions.

By careful chiselling of the lower block of specimen B, Mr. Hall has succeeded in exposing the outline of the right humerus. This, in its widely expanded proximal end and narrow shaft, is seen to be extremely similar to that of *Procolophon* ||. Length 26 millim.; greatest proximal width 14; least width of shaft 3. The femur of the same specimen measures about 30 millim.

The hind limb is well shown in specimen A, and the penultimate phalanx of the fifth toe, which has been overlooked by Huxley, appears clearly on the gutta-percha impressions which have now been taken. The phalangeal formula is, therefore, 2.3.4.5.3.

* Pl. XXXII.

† *Cf.* Broom, Rec. Albany Mus. i. 1903, p. 22, pl. i. fig. 5.

‡ *Cf.* Mantell, *l. c.* pl. iv. fig. 8. The representation of the impression by the lithographer is, however, very incorrect.

§ Far too little attention has been paid, in defining groups of Reptiles, to what Gadow calls the "crucial features" of the præacetabular and postacetabular position of the iliosacral connexion (Zeitschr. f. Morphol. iv. 1902, p. 361). Whilst Batrachia generally (excluding the Ecaudata) are indifferent, the Pariosauria and Anomodontia are "præacetabular," and lead to the Mammalia, and all other orders of Reptiles are "postacetabular," or show a tendency in this direction. This, in my opinion, speaks against the attempt which has recently been made by Osborn (Mem. Am. Mus. i. 1903, p. 456) to derive the "postacetabular" Chelonia and Plesiosauria from the Cotylosauria and Anomodontia, in his subclass Synapsida, to which I shall again refer later on.

|| *Cf.* Seeley, *l. c.* pl. ix.

Procolophon, according to Broom *, has 2.3.4.5.? phalanges in the hind limb. Huxley restored the foot as with one large proximal and four small distal tarsals †. Broom, in *Procolophon*, has found two proximal elements—tibiale fused with intermedium, and radiale—and four distals. In *Telerpeton* there appears to me to have been two bones in the proximal tarsal row, or if there was but one it shows a distinct trace of the fusion of two. The difference between the foot of *Telerpeton* and that of *Procolophon* would therefore be restricted to the shape, the former being longer and more slender than the latter.

In concluding this review of the characters which can be safely ascertained on the material with which I have been entrusted, I must add that I have failed to find any traces of "abdominal ribs," and I feel certain that if any vestiges of a plastron existed these must have been extremely slight. Broom, however, has found impressions of a series of plastral bones, apparently in the posterior abdominal region, on one specimen of *Procolophon* ‡.

Affinities of Telerpeton.

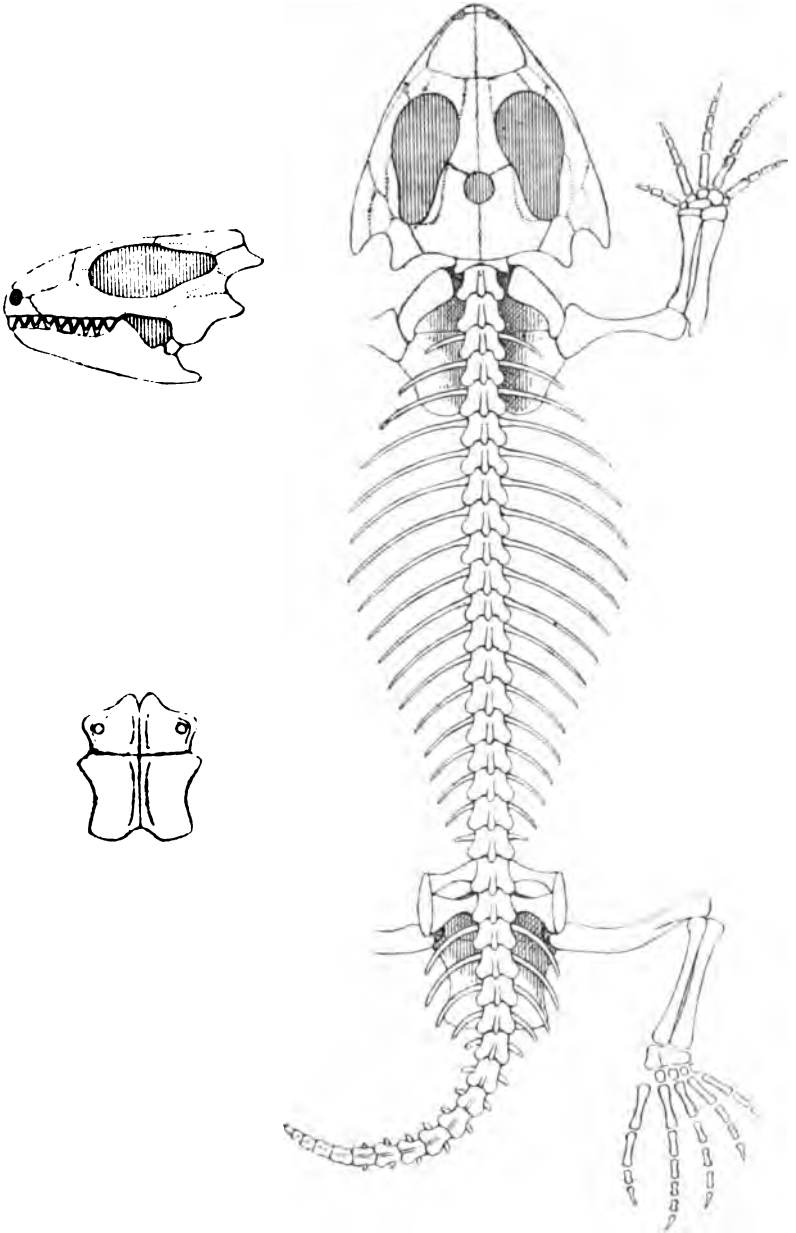
Having reached the conclusion that *Telerpeton* is closely related to *Procolophon*, it is of course unnecessary to consider its supposed Lacertilian affinities. Nor should I have thought it worth while to give reasons for its not being a Rhynchocephalian, had not Dr. Broom § recently revived the opinion once held || but since abandoned by Seeley, that *Procolophon* should be referred to that order, or at least "somewhere among the primitive Rhynchocephalians,—possibly not far from *Palæohatteria*," a view which has been endorsed by Prof. H. F. Osborn ¶, in whose Classification a new Superorder, *Diaptosauria*, is established to include the *Rhynchocephalia* of Zittel, the *Pelycosauria* of Cope, the *Proganosauria* of Baur, and the *Procolophonia* and *Mesosauria* of Seeley **.

The thecodont dentition, the absence or great reduction of the plastral bones, and especially the presence of ossified præcoracoids, are characters which are opposed to an association of the Procolophonia with the Rhynchocephalia, whilst in these characters, as well as in the general structure of the skull, they agree with *Pariosaurus* and *Sclerosaurus* ††, which, together with *Elginia*, constitute the group *Pariosauria*, united by Cope and by Osborn with the Cotylosauria.

The Order Cotylosauria was proposed by Cope in 1880 ‡‡ as a division of the Theromorpha, to include the *Diadectidæ*, on the

* *L. c.* p. 22, pl. i. fig. 6.
† *L. c.* p. 78, fig. C.
‡ *L. c.* p. 21.
§ *L. c.* p. 24.
|| Quart. Journ. Geol. Soc. xxxiv. 1878, p. 808.
¶ "The Reptilian Subclasses Diapsida and Synapsida and the Early History of the Diaptosauria," Mem. Amer. Mus. i. p. 451 (1903).
** Prof. Osborn's arguments have failed to convince me of the soundness of his view that the *Mesosauria* have nothing to do with the *Nothosauria*. *Neusticosaurus*, which he places in the latter group, certainly shows decided affinity to *Mesosaurus*, and I cannot see any fundamental difference in the rib-articulation of the two types.
†† *Aristodesmus* Seeley (*Labyrinthodon ruetimeyeri* Wiedersh.).
‡‡ Amer. Natur. xiv. p. 804.

Text-fig. 99.



Restoration of *Telerpeton elginense*, upper aspect, with side view of skull and lower view of pubis and ischium. The manus is entirely hypothetical.

ground of the articulation of the skull with the atlas by a pair of cotyles in the basioccipital bone, corresponding in position with the Mammalian occipital condyles, whilst the median part of the bone, which forms the floor of the foramen magnum, is produced in the position occupied by the median occipital condyle of Reptiles. Cope alludes at the same time to an "enormous frontoparietal foramen."

In Cope's classification of 1889 * the Cotylosauria are defined as Theromora with the coracoid reduced, not meeting the sternum, the ribs single-headed, the temporal fossa "overroofed," the dentition "abundant," and intercentra present. The Pariosauridæ are included in addition to the Diadectidæ; and in his last contribution, "The Reptilian Order Cotylosauria," † the Elginidæ and Pariotichidæ ‡ are also added, the former of which appear, from our present, imperfect knowledge, to be close allies of the Pariosauridæ, without any special affinity to the Diadectidæ.

The restoration of the very imperfect upper part of the skull of *Diadectes* and allies, as originally given by Cope §, is not to be relied upon, since the illustrious American palæontologist, in his later writings, defined the Cotylosauria as with the temporal region entirely roofed over by bone. That a small supratemporal fossa might have existed appears from the following brief statement recently made by Case ‖:—"It is of interest to note that the author discovered perforations in the roof of the skull of the Diadectidæ in the Cope Collection in the position of the superior temporal vacuities; the forms are too specialised to make the interpretation of this occurrence certain, but it may well be the first step towards the Proganosaurian type." Dr. Case, has however, since written to me (Dec. 12, 1903) that these vacuities do not occur in a second specimen from the same region in the Cope Collection. He kindly adds:—"The skull of the Diadectids is very rugose and the sutures are very obscure; there are certainly no distinct temporal arches and the position and limits of the bones of the temporal region is uncertain. The whole region was covered by a complete roof in all the specimens but the one noticed, and the quadrate is closely connected with the roof-bones, so that the whole region has a strong superficial resemblance to the turtles." Dr. Case has ascertained, moreover ¶, that the pectoral arch of the Diadectidæ consists of scapula, coracoid, precoracoid, clavicle, and interclavicle. Cope ** has given a very brief description of a Diadectid pelvis, which agrees in all essential characters with that of *Procolophon* and *Telerpeton*.

* Amer. Natur. xiv. p. 304. In this classification, the *Procolophonidæ* are placed in the incongruous assemblage Proganosauria.

† *Op. cit.* xxiii. p. 866.

‡ E. T. Newton, Phil. Trans. clxxxiv. B, 1893, p. 473; E. C. Case, Zool. Bull. ii. 1899, p. 231.

§ Proc. Amer. Philos. Soc. xix. 1880, pl. v.

‖ Amer. Natur. 1903, p. 99, footnote.

¶ Amer. Journ. Geol. xi. 1903, pp. 397 & 400.

** Proc. Amer. Philos. Soc. xx. 1882, p. 448.

It is extremely regrettable that our knowledge of the American Cotylosauria should still be so meagre, but what we know shows them to be a type closely related to the Pariosaurians, though differing from them in at least one important character, the absence of the cleithrum. The same may be said of the Procolophonia (*Procolophon* and *Telerpeton*), and therefore these must be regarded, in the light of our present knowledge, as pertaining to the same group, for which the earlier name Cotylosauria should be used.

The order Cotylosauria may be defined as thecodont Reptiles with the temporal region roofed over (without or with a single temporal foramen), with clavicles and interclavicle, with coracoids and præcoracoids (epicoracoids), without or with a very vestigial plastron, and with the number of phalanges as in typical Reptiles. The absence of cleithra and the presence of more than 2.3.3.4.3 phalanges * distinguishes them from the Pariosauria; the second character and the roofing over of the postorbital part of the skull distinguish them from the Anomodontia; whilst the presence of ossified præcoracoids and the absence or extreme reduction of the plastron separate them from all the other primitive orders, such as Rhynchocephalia, Plesiosauria, Thecodontia, &c., with the possible exception of the Pelycosauria, which likewise flourished in Permo-Triassic times.

The order Cotylosauria would comprise four families, the definition of the American types being derived from the contributions of Cope † and of Case ‡.

A. Supratemporal roof broad, orbit small, nearly in the middle of the length of the head; no latero-temporal vacuities; upper surface of skull more or less sculptured.

Teeth small, not transversely expanded, in two rows in the posterior part of the jaws ..... 1. *Pariotichidæ*.
Lateral teeth large, with the crowns expanded transversely to the axis of the jaw, in a single series ..... 2. *Diadectidæ*.

B. Supratemporal roof narrow, orbit very large; skull smooth; lateral teeth expanded transversely to the axis of the jaws.

No latero-temporal vacuity ..... 3. *Telerpetidæ*.
A small latero-temporal vacuity ..... 4. *Procolophonidæ*.

In his important memoir quoted above, Prof. Osborn has proposed a diphyletic arrangement of the Reptilia with which I would be disposed to agree but for the inclusion of the Chelonia and Plesiosauria in the Synapsida, which comprise the Pariosauria, Cotylosauria (exclusive of the Procolophonia), and Anomodontia, and of the Procolophonia in the other subclass, named Diapsida. Both subclasses were evidently derived from Stegocephala with the temporal region completely roofed over. The Pariosauria were probably connected with the Labyrinthodontia and led to

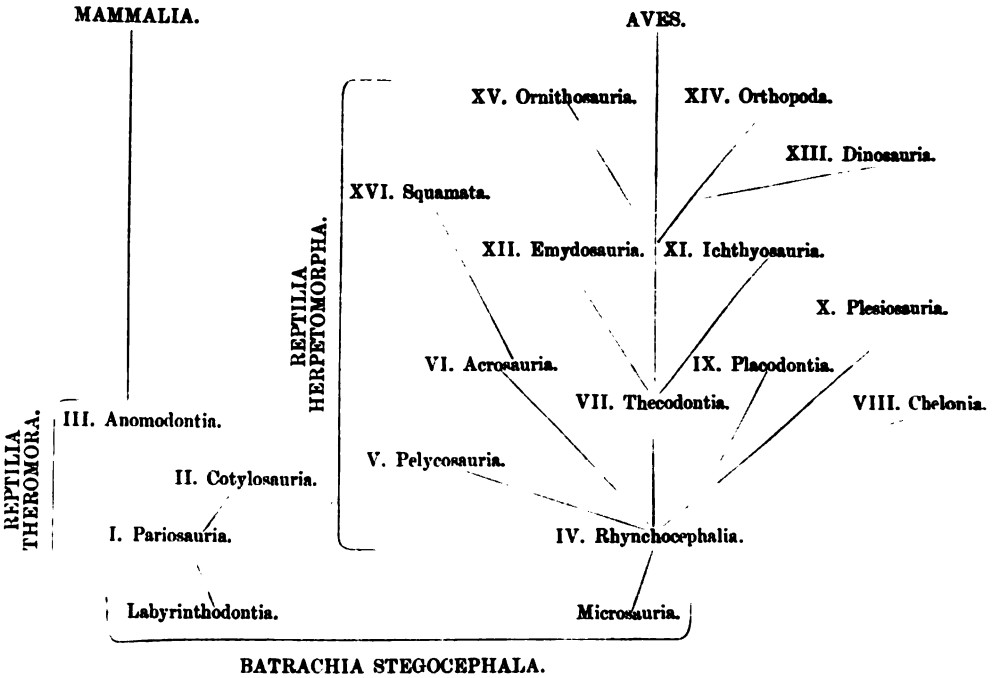
* I cannot understand what can have induced Dr. Broom to restore *Pariosaurus* with 2.3.4.5.4 phalanges in the manus and in the pes. The formula is 2.3.3.4.3 in the specimen in the British Museum.

† Proc. Amer. Philos. Soc. xxxiv. 1895, p. 436.

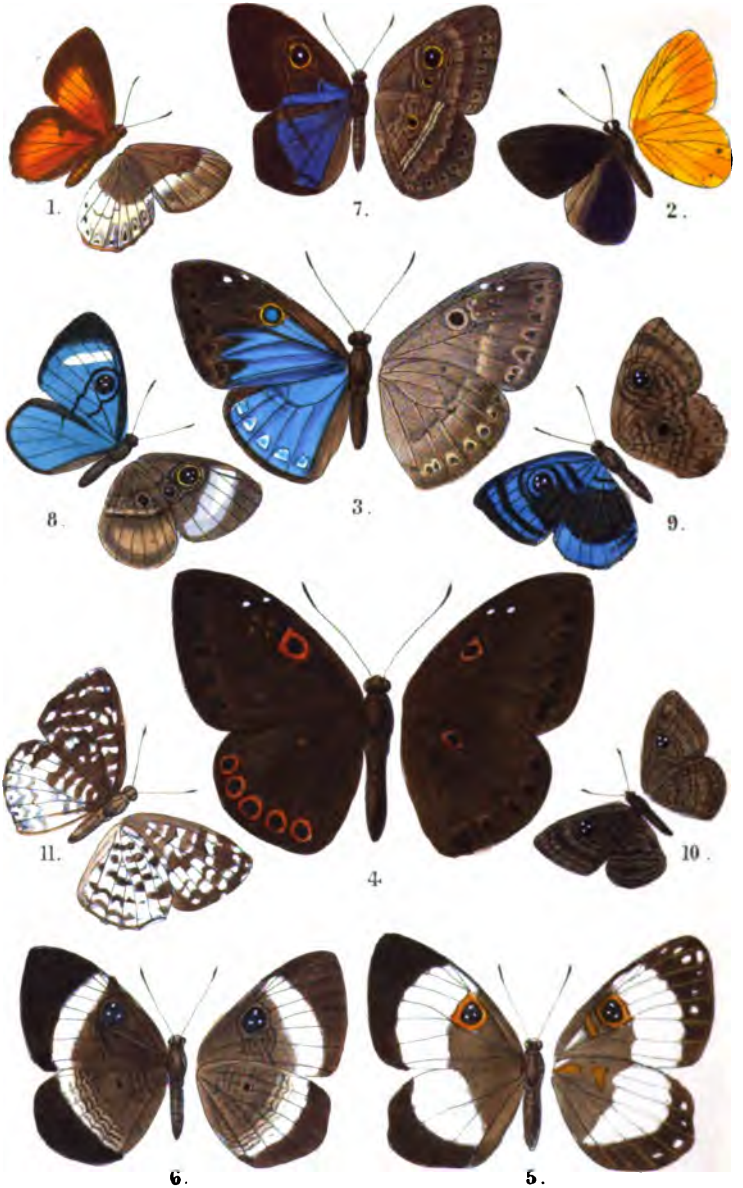
‡ Zool. Bull. ii. 1899, p. 231.

the Mammalia through the Anomodontia, the Cotylosauria being a side-branch issued from the Pariosauria. The Rhynchocephalia may have been evolved out of the Microsauria, and branched off into many phyla, one of which culminated in the Birds. My objection to the Chelonia and Plesiosauria being placed with the Pariosauria or Anomodontia rests on the ground that it cannot be conceived that these two orders could have been derived from forms in which the quadrate is more or less reduced, the plastron, or system of "abdominal ribs," has disappeared or at any rate become extremely reduced, and in which the pelvis slants backwards, all features which are the opposite of those characteristic of the Chelonia and Plesiosauria.

The following diagram expresses what I regard as the probable phylogenetic relations of the orders of Reptiles with which we are at present acquainted :—

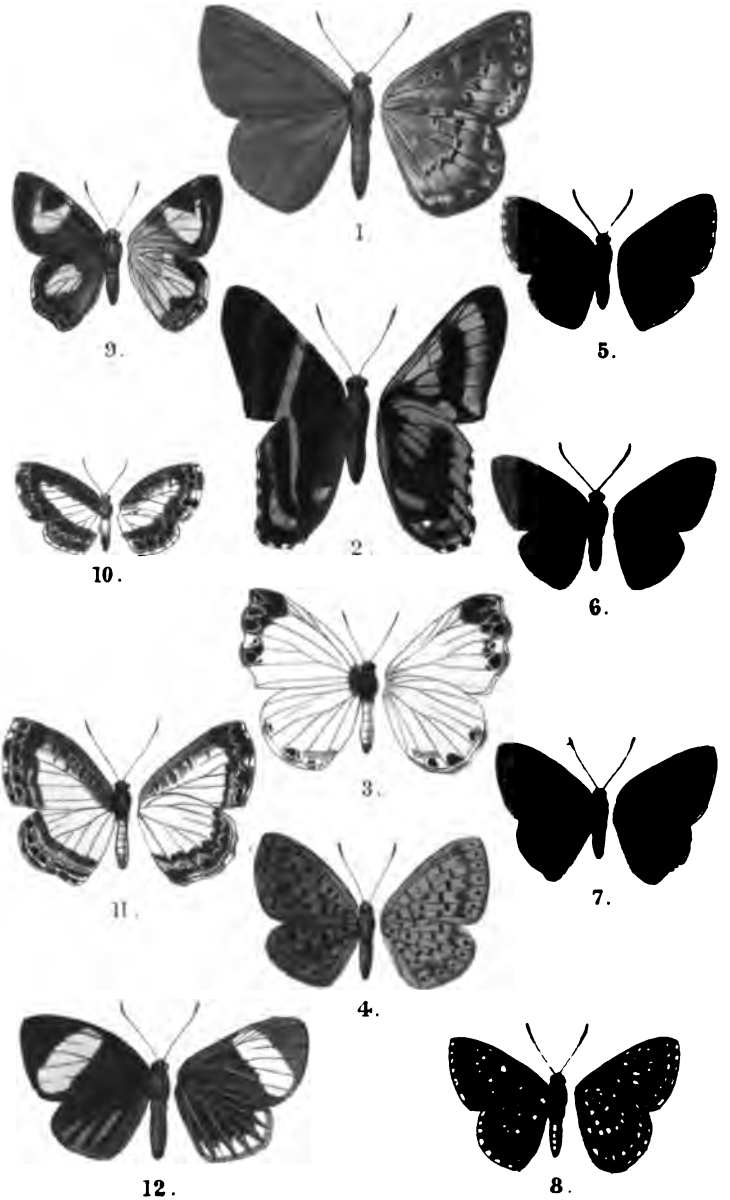


For obvious reasons, I cannot accept the names Synapsida and Diapsida for the two phylogenetic series. I will designate the first subclass by the name Theromora of Cope, in a restricted sense, and suggest for the second that of Herpetomorpha. The Theromora may be divided into three orders, the Herpetomorpha into thirteen.



W Purkiss del et lith. Mintern Bros imp.

NEW SPECIES OF TROPICAL SOUTH AMERICAN ERYCINIDÆ.



W Purkiss del. et lith.

Mintern Bros imp.

NEW SPECIES OF TROPICAL SOUTH AMERICAN ERYCINIDÆ.

EXPLANATION OF THE PLATES.

PLATE XXX.

Slab showing dorsal aspect of specimen B (p. 471) of *Telerpeton elginense*. Reduced to $\frac{1}{2}$.

PLATE XXXI.

Fig. 1. Counter-slab (anterior part) of specimen B of *Telerpeton elginense*. Reduced to $\frac{1}{2}$.
2. Imperfect skull, specimen C (p. 471), of *Telerpeton elginense*. Reduced to $\frac{1}{2}$.
3. Lower aspect of imperfect skull of *Procolophon trigoniceps* (Brit. Mus. no. 794), to show dentition. Reduced to $\frac{1}{2}$.

PLATE XXXII.

Gutta-percha casts of specimen A (p. 470) of *Telerpeton elginense*, from the two principal pieces, natural size.

4. Descriptions of some new Species of Butterflies belonging to the Family *Erycinidæ* from Tropical South America.

By HERBERT DRUCE, V.P.Z.S., F.L.S.

[Received April 18, 1904.]

(Plates XXXIII. & XXXIV.*)

EURYGONA OCALEA, sp. n. (Plate XXXIII. fig. 1.)

Male. Head and antennæ black, collar, tegulæ, thorax, and abdomen yellowish brown. Primaries dark brown, with a large spot, from the base to the middle, reddish brown, chrome-yellow beyond; fringe dark brown. Secondaries reddish brown, shading to chrome-yellow near the apex, the costal, outer, and inner margins bordered with dark brown. Under side:—Primaries pale brown, crossed beyond the cell from the costal to the inner margin by a curved dark brown line, the wing on the outer side of the line being white near the anal angle; a submarginal row of minute black dots extends from the apex to the anal angle; the fringe reddish brown. Secondaries: the base and outer margin pale brown, the other part of the wing white; a waved brown line crosses the wing beyond the cell from the costal to the inner margin; a submarginal row of black spots with white points from the apex to the anal angle; a marginal yellow line extends from the anal angle almost to the apex of the fringe. Expanse $1\frac{3}{10}$ inch.

Hab. Bolivia: La Paz, 3500 feet (*Mus. Druce*).

This species is allied to *Eurygona eucerus* Hew. from Brazil. It is very distinct on the under side.

EURYGONA CANDARIA, sp. n. (Plate XXXIII. fig. 2.)

Male. Head and palpi white; antennæ, collar, tegulæ, thorax,

* For explanation of the Plates, see p. 489.

and abdomen black. Primaries and secondaries black glossed with dark blue. Under side: thorax, legs, and both wings deep chrome-yellow; a black spot on the outer margin of the secondaries and two small black points close to the anal angle. Expanse $1\frac{3}{10}$ inch.

Hab. Colombia: Bogota (*Mus. Druce*).

Allied to *Eurygona gelanor* Cram., but much blacker on the upper side and without any lines crossing the wings on the under side.

EURYBIA CÆRULESCENS, sp. n. (Plate XXXIII. fig. 3.)

Male. Head, antennæ, collar, tegulæ, thorax, and abdomen brown, palpi pale yellow. Primaries brown, glossed with bright blue from the base to beyond the middle; a large black spot edged with yellow, and with a bright blue point in the middle, at the end of the cell; two white dots on the costal margin beyond the cell; a submarginal row of very indistinct dark brown spots edged with paler brown extends from the apex to the anal angle, the fringe dark brown. Secondaries bright blue, the costal and outer margin edged with brown; a submarginal row of spots edged with yellow extends from the apex to the anal angle. Under side greyish brown, the spots on both wings similar to those of the upper side but more distinct; the legs greyish brown. Expanse $2\frac{1}{4}$ inches.

Hab. Peru: Rio Perene (*Mus. Druce*).

This species is allied to *Eurybia lycisca* Doubl. & Hew., but it is at once distinguished from that species by the bright blue on the primaries and the two white spots on the costal margin; the shade of blue on the secondaries is lighter and brighter in colour than in *E. lycisca*.

EURYBIA SINNACES, sp. n. (Plate XXXIII. fig. 4.)

Male. Head, antennæ, collar, tegulæ, thorax, abdomen, and legs dark brown; palpi orange-red. Primaries dark brown, a large round black spot edged with orange-red at the end of the cell; beyond the end of the cell close to the costal margin two white spots, the one nearest the margin considerably the smaller. A submarginal row of very indistinct dark brown spots edged on the inner side with reddish brown extends from the apex to the anal angle. Secondaries dark brown, with the marginal spots larger and much more distinct, the fringes of both wings dark brown. Under side very similar to the upper side, but the marginal spots are very indistinct. A black dot edged with orange-red at the end of the cell on the secondaries. Expanse $2\frac{3}{4}$ inches.

Hab. Peru: Upper Rio Toro, Las Mercedès (*Mus. Druce*).

Also in Mr. Godman's collection from Canellos, Ecuador. This species is not very closely allied to any described *Eurybia*.

MESOSEMIA AXILLA, sp. n. (Plate XXXIII. fig. 5.)

Female. Head, antennæ, thorax, and abdomen dark brown. Primaries dark brown, crossed beyond the cell from the costal to the inner margin by a wide curved white band; a large black spot at the end of the cell edged with yellow, three small white dots about the middle of the black spot. Secondaries brown, the central portion of the wing white from the costal margin to nearly the anal angle, the fringe of both wings dark brown. Under side:—Primaries similar to the upper side, but with the veins yellow and a submarginal row of white spots, the spot at the end of the cell more distinct and a yellow line between it and the base. Secondaries similar to the upper side, but with four white spots on the outer margin nearest the apex and a yellow line on the costal margin. Expanse 2¼ inches.

Hab. Bolivia: La Paz (*Mus. Druce*).

This species is allied to *Mesosemia marsidia* Hew., but it differs from it in the very much wider white bands on both wings and the entire absence of the white submarginal spots on the primaries.

MESOSEMIA ANICA, sp. n. (Plate XXXIII. fig. 6.)

Head, antennæ, collar, tegulæ, thorax, abdomen, and legs dark brown. Primaries dark brown, crossed beyond the cell from the costal to the inner margin close to the anal angle by a rather wide slightly curved white band; a large black spot at the end of the cell with three white points in it, the white point nearest the inner margin of the black spot twice the size of the other two white points. Secondaries dark brown, crossed from the costal to the inner margin by a white band almost filled up with fine-waved dark brown lines, the fringes of both wings dark brown. Under side of both wings very similar to the upper side, but paler in colour. Secondaries with a black spot about the middle edged with white. Expanse 2 inches.

Hab. Peru (*Mus. Druce*).

This species is allied to *Mesosemia thymetus* Cram., but it differs from it in the white band of the primaries being much narrower and that on the secondaries crossed by fine waved dark brown lines.

MESOSEMIA PARAMBA, sp. n. (Plate XXXIII. fig. 7.)

Male. Head, antennæ, collar, thorax, abdomen, and legs brown. Primaries dark brown, a round black spot edged with yellow at the end of the cell, a blue spot with a white point in the middle of the black spot, a yellow line near the base of the cell and one beyond the cell; the inner margin from the base almost to the apex dark blue, the fringe dark brown. Secondaries dark blue, the outer margin from the apex to the inner margin broadly

bordered with dark brown; a short brown line partly crosses the wing from the costal margin to the end of the cell. Under side pale brown. Primaries: the black spot as on the upper side, below which is a small black spot edged with yellow, both spots enclosed by several dark lines; a reddish-brown band crosses the wing from the costal margin beyond the cell to the inner margin, beyond which is a submarginal narrow black line. Secondaries very similar to the primaries, with a small black spot at the end of the cell. Expanse 1½ inch.

Hab. N.W. Peru: Paramba, 3500 feet (*Rosenberg*, *Mus. Druce*).

Allied to *Mesosema lamackus* Hew., but without the brown lines on the secondaries.

MESOSEMIA CANDARA, sp. n. (Plate XXXIII. fig. 8.)

Male. Head, collar, tegulæ, thorax, and abdomen black, the under side of the thorax, abdomen, and legs pale brown. Antennæ black ringed with white. Primaries bright blue, the apex and outer margin black; a narrow white band partly crosses the wing from the costal margin nearly to the middle of the outer margin; a large round black spot with white points in it at the end of the cell, on each side of which a narrow black line crosses the wing from the costal to the inner margin. Secondaries bright blue, the costal, outer, and inner margins edged with black. Under side pale greyish brown, the white band on the primaries about three times the width as above and extending to the anal angle; the black spot the same as above, but edged with yellow; a small black spot just below the larger one, the lines very similar to those on the upper side. Secondaries: a black spot at the end of the cell with one white point in the middle, the wing crossed on both sides of the black spot from the costal to the inner margin by a dark brown line edged with paler brown on the inner side; a rather wide very indistinct submarginal band extends from the apex to the anal angle. Expanse 1½ inch.

Hab. Peru: Chanchamayo (*Mus. Druce*).

This butterfly to some extent resembles *Mesosemia loruhama* Hew. from Ecuador, but it is of a darker blue colour and has only one black spot on the primaries instead of two as in *M. loruhama*, and on the under side it differs in several small details.

MESOSEMIA CARDERI, sp. n. (Plate XXXIII. fig. 9.)

Male. Head, antennæ, collar, abdomen, and legs black; thorax metallic dark blue. Primaries black, the base, costal margin, and two bands crossing the wing beyond the cell dark blue; a black spot at the end of the cell with three white points, the spot partly edged with blue on the costal side, the fringe black. Secondaries black, broadly bordered with dark blue from the apex to the anal angle, the base blue. Under side: primaries and secondaries pale greyish brown, both crossed by a number of dark

brown waved lines; a black spot with white points at the end of cell of both wings; the fringes blackish brown. Expanse 1½ inch.

Hab. Colombia, near Bogota (*Mus. Druce*).

Allied to *Mesosemia meeda* Hew., but very distinct on the under side.

MESOSEMIA PARISHI, sp. n. (Plate XXXIII. fig. 10.)

Male. Head, antennæ, collar, tegulæ, thorax, and abdomen dark brown. Primaries dark brown, crossed beyond the cell by three darker brown lines, the submarginal line waved, the second the widest; a round black spot with three white points at the end of the cell edged with yellowish brown. Secondaries dark brown, crossed about the middle from the costal to the inner margin by two narrow very dark brown lines; a waved submarginal line extends from the apex to the anal angle. Under side very similar to the upper side but very much paler in colour, the fringes of both wings dark brown. Expanse 1¼ inch.

Hab. British Guiana: Bartica (*Mus. Druce*).

Similar to *Mesosemia ibycus* Doubleday, from the Amazons.

CREMNA AZA, sp. n. (Plate XXXIII. fig. 11.)

Male. Head, antennæ, collar, tegulæ, thorax, and abdomen pale greyish brown. Primaries pale greyish, crossed from the costal to the inner margin by a series of uneven white lines broken into spots; fringe alternately brown and white. Secondaries: the base pale greyish brown spotted with white, the outer half of the wing white, crossed by indistinct greyish waved lines. Under side similar to the upper side but whiter. Expanse 1½ inch.

Hab. Interior of Colombia (*Mus. Druce*).

This species is allied to *Cremna cenens* Cram., but it is at once distinguished from it by the white hind wings; it is also near *Cremna malis* Godman.

ERYCINA MENDITA, sp. n. (Plate XXXIV. fig. 2.)

Male. Head, antennæ, collar, tegulæ, thorax, and abdomen black. Primaries black, crossed about the middle from the costal to the inner margin by a bright crimson band, widest on the inner margin, the fringe black. Secondaries black, crossed from the apex almost to the inner margin just above the anal angle by a bright crimson band, below which a second broad, short, crimson band extends from the anal angle partly round the outer margin; the fringe alternately black and white. Under side:—Primaries bright dark glossy blue, the apex, base, inner margin, and a wide central band crossing the wing from the costal margin to the anal angle all black; a large red spot on the inner margin nearest the anal angle. Secondaries bright dark blue, with a wide central black band; the inner margin is black edged with blue, a bright

red band above the anal angle extending partly across the wing, a small white spot at the angle. Expanse 2 inches.

Hab. Bolivia: La Paz, 3000 feet (*Mus. Druce*).

This species is allied to *Erycina etias* Saunders, but it differs from it in having a much broader hind wing.

SISEME PECULIARIS, sp. n. (Plate XXXIV. fig. 9.)

Male. Head, antennæ, collar, tegulæ, thorax, and abdomen black. Primaries black, crossed at the end of the cell from the costal to almost the outer margin by a cream-coloured band which becomes widest near the outer margin; a faint cream-coloured line extends from near the apex and joins the central band on the outer margin; the fringe black. Secondaries black, with a large cream-coloured spot extending from the end of the cell almost to the outer margin; a faint greyish submarginal line extends from the apex to the anal angle, two small yellow spots at the anal angle; fringe black, excepting a short space which is white about the middle of the outer margin. Under side similar to the upper side, but with all the cream-coloured markings much larger. Expanse 1½ inch.

Hab. N. Peru: Huancabamba, 6000–10,000 feet (*Mus. Druce*).

This species has no near ally that I am acquainted with.

CHARIS CANDIOPE, sp. n. (Plate XXXIV. fig. 5.)

Male. Head, antennæ, collar, tegulæ, thorax, and abdomen blackish brown. Primaries and secondaries blackish brown, both wings crossed by a number of indistinct black lines broken into spots; a submarginal and marginal metallic line crosses both wings from the apex to the anal angle; a row of minute black dots edged with reddish brown extends from the apex to the anal angle of the secondaries; the fringes alternately dark brown and white. Under side reddish brown, thickly streaked with fine short black lines. Expanse 1¼ inch.

Hab. Colombia (*Mus. Druce*).

CHARIS MANDOSA, sp. n. (Plate XXXIV. fig. 6.)

Male. Head, antennæ, collar, tegulæ, thorax, and abdomen black. Primaries and secondaries blackish brown, with indistinct lines crossing both wings; a marginal row of spots extends from the apex to the anal angle; the fringes black. Under side very similar to the upper side, but with a greenish gloss over both wings. Expanse 1¼ inch.

Hab. South Brazil: Rio Janeiro (*Mus. Druce*).

CHARIS MYRTIS, sp. n. (Plate XXXIV. fig. 7.)

Male. Head, antennæ, collar, tegulæ, thorax, and abdomen black. Primaries and secondaries dull brown crossed by waved

black lines; the outer margins of both wings streaked with metallic lines. Under side similar to the upper side, but paler in colour and without the metallic lines on the margins. Expanse 1¼ inch.

Hab. Argentine Republic: Salta (*Reeve*, *Mus. Druce*).

LEMONIAS AURIA, sp. n. (Plate XXXIV. fig. 4.)

Head, collar, tegulæ, thorax, and abdomen reddish brown; antennæ black. Primaries brown, the apex and outer margin reddish brown, crossed by a number of black dots and streaks; a marginal row of black spots extends from the apex to the anal angle; the ends of all the veins metallic lead-colour; the fringe dark brown. Secondaries almost identical with the primaries. Under side very similar to the upper side, but light yellowish brown, with all the spots as on the upper side. Expanse 1¼ inch.

Hab. Bolivia: La Paz (*Mus. Druce*).

NYMPHIDIUM CANDACE, sp. n. (Plate XXXIV. fig. 1.)

Male. Head, antennæ, collar, tegulæ, thorax, and abdomen reddish brown. Primaries and secondaries reddish brown; a row of very indistinct small brown dots crosses both wings beyond the middle; an indistinct bluish-white submarginal line extends from the apex to the anal angle of both wings; the fringes brown. Under side:—Primaries dark brown, irrorated with greyish scales at the base along the inner margin and near the anal angle; a dark brown row of spots edged with grey on the inner side crosses the wing beyond the cell from the costal to the inner margin; a marginal row of small greyish-white dots extends from the apex to the anal angle. Secondaries dark brown, thickly irrorated with greyish-white scales; the bands of spots very similar to those on the primaries; the under side of the abdomen greyish white. Expanse 2 inches.

Hab. S.E. Brazil: Rio Janeiro (*Mus. Druce*).

This species is nearest to *Nymphidium arctos* Hew., from the Amazons.

NYMPHIDIUM MINUTA, sp. n. (Plate XXXIV. fig. 10.)

Male. Head, antennæ, collar, tegulæ, and thorax black; abdomen white, the three anal segments black. Primaries white, broadly bordered with black on the costal and outer margins; a marginal row of bluish-white rings extends from the apex to the anal angle; the fringe alternately white and black. Secondaries white, the base and outer margin black; the marginal white rings the same as on the primaries. Under side very similar to the upper side, but whiter, and the markings round the outer margins much plainer. Expanse 1 inch.

Hab. British Guiana: Bartica (*Mus. Druce*).

NYMPHIDIUM AUGEA, sp. n. (Plate XXXIV. fig. 11.)

Female. Head, antennæ, collar, tegulæ, and thorax black; abdomen and legs yellowish white. Primaries yellowish white, the base, costal margin, apex, and outer margin broadly bordered with dark blackish brown; some minute black streaks along the costal margin edged pale grey; a marginal greyish-white waved line extends from the apex to the anal angle; a submarginal orange-red streak close to the anal angle. Secondaries yellowish white; a submarginal wide orange-red band, bordered on both sides with dark brown, extends from the apex to the anal angle; a marginal bluish-white waved line follows the orange band round the outer margin; the fringes of both wings black and white. Under side similar to the upper side, but the dark margins to the wings broken into spots. Expanse 1½ inch.

Hab. Bolivia: La Paz (*Mus. Druce*).

NYMPHIDIUM MEDUSA, sp. n. (Plate XXXIV. fig. 3.)

Male. Head, collar, tegulæ, and thorax black; antennæ black, ringed with white; abdomen white, the anus black; legs white. Primaries white, the base, apex, and part of the outer margin black; a zigzag white line crosses the black apex and continues partly down the outer margin. Secondaries white, with three black spots round the outer margin; a chrome-yellow streak at the anal angle. Under side the same as the upper side. Expanse 1½ inch.

Hab. Peru: Chanchamayo, Rio Colorado (*Mus. Druce*).

Near *Nymphidium leucosia*.

ARICORIS STRIATA, sp. n. (Plate XXXIV. fig. 12.)

Female. Head, antennæ, collar, tegulæ, thorax, and abdomen black; under side of thorax and legs brown. Primaries black, crossed beyond the cell from the costal margin to the anal angle by a wide white band; the fringes black. Secondaries black, streaked with blue near the anal angle. Under side pale brown, the veins all yellowish brown; the white band on the primaries as on the upper side; the secondaries with a marginal row of white spots. Expanse 1¾ inch.

Hab. Ecuador (*Mus. Druce*).

Nearest *Aricoris jansoni* Butler, but with no blue gloss on the upper side, and a white band instead of a yellow one.

STALACHTIS CANIDIA, sp. n. (Plate XXXIV. fig. 8.)

Male. Head, antennæ, collar, tegulæ, and legs dark brown; palpi black above, white on the under side; abdomen black, the three anal segments white on the upper side, the anus black, a row of four white spots on each side of the abdomen, the under

side reddish brown. Primaries dark brown, the costal margin and half the base of the wing reddish brown to the end of the cell; a white point in the cell and a larger one at the end of the cell; beyond the cell a curved line of seven white dots crosses the wing from the costal to the inner margin; a submarginal reddish-brown band extends from near the apex almost to the anal angle; the fringe alternately brown and white. The secondaries very similar to the primaries. Under side: both wings very like the upper side, but the reddish-brown band brighter in colour and rather wider, the white spots larger and more numerous; also a marginal row of small white dots on both wings extends from the apex to the anal angle; the fringes as on the upper side. Expanse 1¼ inch.

Hab. N. Brazil: Matto Grosso, Chapada (*H. H. Smith*) (*Mus. Godman*).

Allied to *Stalachtis sontella* Schaus, from Castro Paraña.

EXPLANATION OF THE PLATES.

Plate XXXIII.

Fig. 1. *Eurygona ocalea*, ♂, p. 481.
2. *E. candaria*, ♂, p. 481.
3. *Eurybia cærulescens*, ♂, p. 482.
4. *E. sinnaces*, ♂, p. 482.
5. *Mesosemia axilla*, ♀, p. 483.
6. *M. anica*, p. 483.
7. *M. paramba*, ♂, p. 483.
8. *M. candara*, ♂, p. 484.
9. *M. carderi*, ♂, p. 484.
10. *M. parishi*, ♂, p. 485.
11. *Cremna aza*, ♂, p. 485.

Plate XXXIV.

Fig. 1. *Nymphidium candace*, ♂, p. 487.
2. *Erycina mendita*, ♂, p. 485.
3. *Nymphidium medusa*, ♂, p. 488.
4. *Lemonias auria*, p. 487.
5. *Charis candiope*, ♂, p. 486.
6. *C. mandosa*, ♂, p. 486.
7. *C. myrtis*, ♂, p. 486.
8. *Stalachtis canidia*, ♂, p. 488.
9. *Siseme peculiaris*, ♂, p. 486.
10. *Nymphidium minuta*, ♂, p. 487.
11. *N. augea*, ♀, p. 488.
12. *Aricoris striata*, ♀, p. 488.

5. On the Structure of the Theriodont Mandible, and on its Mode of Articulation with the Skull.

By R. BROOM, M.D., B.Sc., C.M.Z.S., Victoria College, Stellenbosch, S. Africa.

[Received March 25, 1904.]

(Plate XXXV.* and Text-figure 100.)

As there are very strong reasons for believing that all mammals are descended from a Theriodont ancestor, all new light on the structure of the Theriodonts must be welcomed by morphologists.

Only a very limited number of good Theriodont skulls have been discovered, and these have almost all been already described by Prof. Seeley. The majority of the types are in London, where they are readily accessible to European and American students, but in the museum at Grahamstown, S. Africa, there are two or three important specimens that seem worthy of more minute study than has yet been given to them.

Recently, through the kindness of Dr. Schönland, I made a careful study of the Grahamstown specimens, with a view to getting more definite information about the structure of the lower jaw and its mode of articulation.

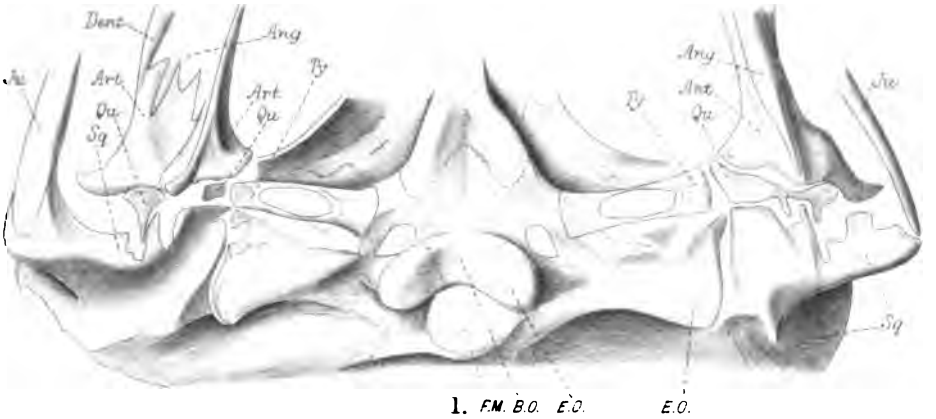
Perhaps the most valuable specimen in the collection is the skull which forms the type of *Cynognathus platyceps*. It is an almost perfect skull, slightly crushed, and wanting only the snout. The mandibles are in position and the matrix has been beautifully cleared away. The specimen has been figured by Prof. Seeley and described at considerable length (1). The figure of the under surface unfortunately has been executed in such a manner that the student cannot readily determine what is matrix and what is bone, while there are no letters given to indicate the position of the different elements.

The mandible is formed mainly by the dentary bone, which is so largely developed that when the jaw is viewed from the outer side all the other elements are completely hidden except in the articular region.

The dentary has a very large coronoid process, which extends almost as far back as the plane of the articular region. The fractured anterior part of the bone shows the small splenial lying in a shallow groove on the inner side of the bone. Posteriorly the dentary received on its inner side the angular and articular bones. The surangular lies on the inner side of the bone near the base of the coronoid process. The specimen does not show very satisfactorily the structure of the posterior part of the dentary.

The articular is fairly well seen in the specimen. It forms a broad articulation with the quadrate and possibly with a small

* For explanation of the Plate, see p. 498.



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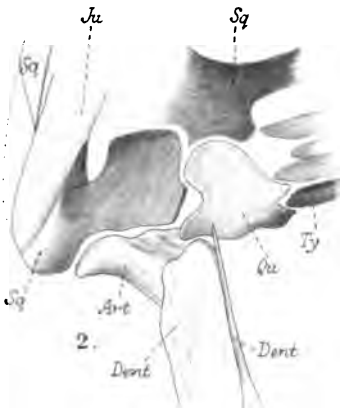

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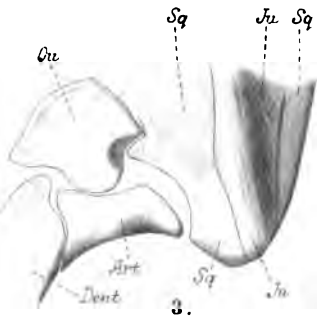

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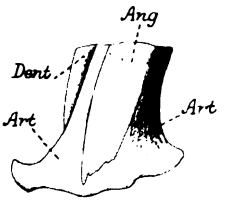

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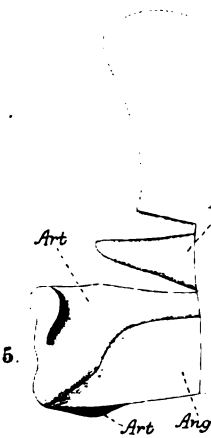

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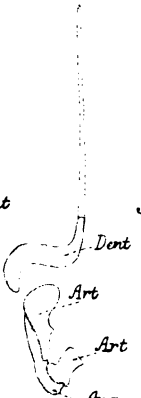

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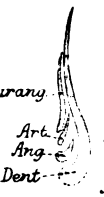

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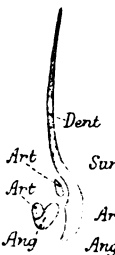

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R. Broom del. M.P. Parker lith. Mintern Bros. imp.

ARTICULATION OF MANDIBLE IN THERIODONTS.

part of the squamosal. The whole of the mandibular articulation is formed by the articular bone. The exact size of the bone is not seen in the specimen as it is largely overlapped by the angular.

The angular is seen between the posterior and under border of the dentary and the articular bone. As seen in the specimen, it appears to be a thin flake of bone lying on the outer side of the articular. A good deal of the bone has, however, been removed while the specimen was being developed, and the angular should extend as far back as the groove which is seen on the outer side of the posterior part of the left jaw.

The surangular is not very well seen in this specimen.

The splenial, except on the fractured surface at the front of the specimen, is also imperfectly displayed.

The quadrate is well shown on the left side and fairly well on the right. In the development of the specimen this region has been to some extent ground down, but this has resulted in the relations of the quadrate to the articular and to the squamosal being well shown. In fig. 1 (Pl. XXXV.) the quadrate is seen interdigitating with the squamosal, almost exactly as in *Cynognathus crateronotus*. On the outer side of the articulation, the articular comes almost in contact with the squamosal, and it seems not improbable that the articulation of the mandible is here directly with the squamosal. On the right side, only a part of the middle and of the inner end of the quadrate is seen.

Passing directly inwards from the inner end of the quadrate there is seen on both sides a very remarkable elongated bone. As it is now seen in the specimen, it appears to be a somewhat cylindrical bone, hollow in the centre, and from which part of the thin wall has been removed during the removal of the matrix. Its outer end evidently articulates with the quadrate, and the inner end with a part of what may be the periotic. Seeley recognises that this bone is evidently the homologue of the dumb-bell-like bone in the similar situation in *Dicynodon*—the bone which, when dealing with the Anomodonts, he believed to be the malleus. In his paper on *Cynognathus* (1895) he says: "I now incline to regard it as a rudimentary straight cochlea." In describing the skull of *Udenodon* in 1901 (2), I expressed the opinion that the bone in the Dicynodonts was the homologue of the mammalian tympanic, and I still incline to this opinion. In *Udenodon* the bone is solid, so that it cannot have lodged any part of the inner ear. In *Dicynodon* the columella auris lies in the hollow formed by the bone and the exoccipital. In *Cynognathus* there is likewise a hollow between the exoccipital ("opisthotic" of Seeley) and this supposed tympanic, and in this hollow there lie one or two tiny bones or portions of bones which may represent the auditory ossicles.

Two other specimens probably of one individual, and belonging to a species of *Cynognathus* (either *C. berryi* or a new species),

throw a considerable amount of additional light on the structure of the jaw.

One of the specimens includes a large part of both mandibles and shows two sections of the jaws—one through the angle and the other considerably further forward. These are shown in figs. 9 & 10, Plate XXXV. In fig. 9 the section is through the anterior part of the coronoid process. On the inner side of the large dentary near the middle is seen the small surangular, with below it two other bones which I believe to be the articular and the angular respectively. In the more anterior section (fig. 10) the surangular has almost disappeared, and below it there are three bones seen on section. The upper two are probably both articular—the inner of the two almost certainly, while the lowermost element is the angular. The detached portion of the dentary at the bottom is due to a very short process at the angle.

The other specimen is the almost perfect articular region of the jaw. It is represented in Pl. XXXV. figs. 4, 5, & 6. The broad articular is seen to be also fairly deep, and on passing backwards it is seen to divide into an upper and a lower process. It is supported on the outer side by the angular. Above the articular is the dentary. Though in the specimen there is a slight gap between the bones, it is probable that the dentary rested on the articular. It will be seen that the dentary has a posterior process which comes very near to the articulation.

With regard to the mandible of *Gomphognathus kannemayeri*, I am unable to accept as conclusive the first two of the text-figures that accompany Seeley's paper (3). I am of the opinion that in the first figure the drawing does not distinguish between the delicate coronoid itself and plaster that has been added to the specimen. In figure 2 the drawing does not adequately represent the back part of the actual specimen, on account of the omission of the angular bone. The specimen is especially valuable in that the jaws are open wide, and a view is thus obtained of the anterior surface of the quadrates. Fig. 2, Plate XXXV., represents the appearance of the articular region, the posterior part of the jaw being seen from above and the articular region of the skull from the front. Fig. 3 is the corresponding region of the opposite side. (When the specimen was first described by Seeley, the back part of the left jaw was broken off and apparently believed to be lost. Fortunately this portion is still preserved, and is now united with the rest of the specimen.) In the lower jaw is seen the back part of the dentary, consisting of the flat part which rests on the articular and the thin coronoid process (*cf.* fig. 6). Beyond the dentary and to the outer side is seen the articular end of the articular bone. The whole structure of the articular region of the jaw is very similar to that in *Cynognathus*. The articular is, however, developed more outwards, and the angular, which passes slightly further back on it, is rather more strongly developed.

On both the right side and the left the quadrate bone appears

to be somewhat displaced inwards and forwards. On the right side it is displaced very considerably, and lies a little in front of the articular. As preserved, it is a moderately flat little bone which probably lay on the front of the inner part of the squamosal. It has probably formed the greater part of the articulation for the articular, though at its outer corner the articular not improbably also formed a small articulation with the squamosal.

Both mandibles show the presence of a supporting plate of bone lying against the inner side of the anterior part of the base of the coronoid process. This is the bone which Seeley believes to be the "coronoid," but which I believe to be the surangular. It is present in all the Theriodont jaws in which this region is exposed, though it is not so well seen in any of the Albany Museum specimens as in some of those in London.

The type skull of *Trirachodon kannemeyeri* shows the articulations of both jaws fairly satisfactorily (3). On each side the articular and angular bones are seen to be almost exactly similar to those in *Gomphognathus*, though the back part of the dentary is relatively more largely developed in *Trirachodon*. The splenial is seen to lie on the inner side of the dentary from the symphysis to near the middle of the jaw.

The quadrate, though not very perfectly displayed, is apparently fixed to the squamosal behind in the same way as in *Cynognathus*, and though the articular is fairly broad, the quadrate appears to form the whole of the articulation.

The bone which I regard as the tympanic is present as a delicate bony rod of about the thickness of a pin. It exactly corresponds in situation with the tympanic in *Cynognathus*.

A rather badly weathered skull of *Trirachodon kannemeyeri*, also in the Albany Museum collection, shows a tangential section through the articulation. This is represented in fig. 11, Pl. XXXV., and though the bones are slightly displaced, a good idea is obtained of the way in which the plate-like quadrate lies in front of the squamosal.

Another specimen of *Trirachodon* shows the fractured sections of the mandible. These are shown in figures 7 and 8, the one being reversed for more ready comparison. Figure 7 is through the anterior part of the coronoid process, and probably through the most developed part of the surangular. On the inner side of the dentary are three bones which I believe to be the surangular, articular, and angular respectively. Figure 8 represents a section through the jaw a little behind the angle of the dentary. The small bones on the inside of the dentary here are the angular and the two posterior processes of the articular.

From the five sections of the Theriodont jaw given from the different specimens, a fairly good idea of the relations of the small bones can be obtained. If they are arranged in the following order, 7, 9, 10, 8, 6, we have a series of five sections from the front of the coronoid process to near the posterior part of the dentary.

Though the known Theriodont genera differ greatly in their dentition, it will be observed that in the structure of the lower jaw and quadrate region they agree with each other very closely, and form by themselves a very distinct order. Much confusion has been caused in the past by there having been placed with the Theriodonts a large number of other forms which are not at all nearly related to them. I refer to such forms as *Æluroscaurus*, and probably the majority of Owen's types with a similar dentition. While very little was known of these forms except that they had the dentition specialised as incisors, canines, and molars, it was but natural to place them with *Galesaurus*; but since the structure of the skull of these "primitive Theriodonts" has become known, it has been necessary to place them in a distinct order, which I have named *Therocephalia* (4). The Therocephalians differ from the Theriodonts in having, besides a large number of other distinctive features, a palate of the Rhynchocephalian type and a single occipital condyle. In the lower jaw the dentary, though possessed of a large coronoid process, is relatively much smaller than in the Theriodonts (see text-fig. 100, p. 496), while the angular is of large size, and the surangular and articular moderately well-developed. The Theriodonts are probably direct descendants of the Therocephalians, but the gap between the groups is very considerable.

In *Dicynodon* and *Udenodon* the lower jaw is essentially similar to that in the Therocephalians, though the coronoid process is quite rudimentary. As the Dicynodonts are probably, like the Theriodonts, also descended from the Therocephalians, the loss of the coronoid process is probably, as in the Monotremes, connected with the loss of the incisor teeth.

The only other group to which the Theriodonts are closely related is the Mammalia. In the present paper I shall avoid any lengthy discussion of the question of the origin of mammals, but I wish to point out how nearly related the Theriodont jaw is to that of the mammal.

The mammal differs from the reptile in having the jaw formed entirely of one bone—the dentary, and in the dentary articulating with the squamosal with apparently no quadrate. What has been the fate of the quadrate is a question which has received a number of very different answers. Owen regarded the tympanic bone as the mammalian equivalent of the quadrate, and this view has the support of Gadow (5) among others. Huxley and many others have argued in favour of one or other of the auditory ossicles being the mammalian quadrate, and the view that the incus is the quadrate appears to be the one chiefly supported by comparative anatomists at the present day. This latter view, though having the strong support of Kingsley (6) and Gaupp (7), has recently been very severely criticised by Gadow (8). Gadow not only shows that the mammalian auditory ossicles are together homologous with the columella and extra-columella of the Sauropsida, but has shown how impossible it would be for an animal to

exist in the intermediate stage when the quadrate was being modified into the incus. "Let us examine," he says, "what terrible intermediate stages this would imply. A lever-bar, the mandible, supported at two places, one behind the other in the long axis. Such a thing would not be able to move; the animal could not use its jaws, and this intermediate stage would also imply the giving up of hearing through the tympanum, and through the columellar or stapedial apparatus, until the quadrate, relieved of its suspensorial function, had slipped in with the articulate [malleus] and had re-established the connection between stapes and tympanum!"

While there can be little doubt that Gadow is right in holding that the mammalian auditory apparatus is homologous with the auditory apparatus of reptiles, his view that the mammalian tympanic corresponds to the reptilian quadrate is very questionable. It is impossible in the present paper to enter into the discussion of the question, but it may be pointed out that the view, though free from the fatal objections that can be urged against the "incus" view, receives no support from either embryology or palæontology, and the support which it seems to get from comparative anatomy is in my opinion the result of misinterpretation of one or two of the facts.

The examination of the Theriodont jaw and of its mode of articulation shows that the condition is already so nearly mammalian that only a very slight modification, and that very easily understood, is required to convert the Theriodont jaw into that of the mammal.

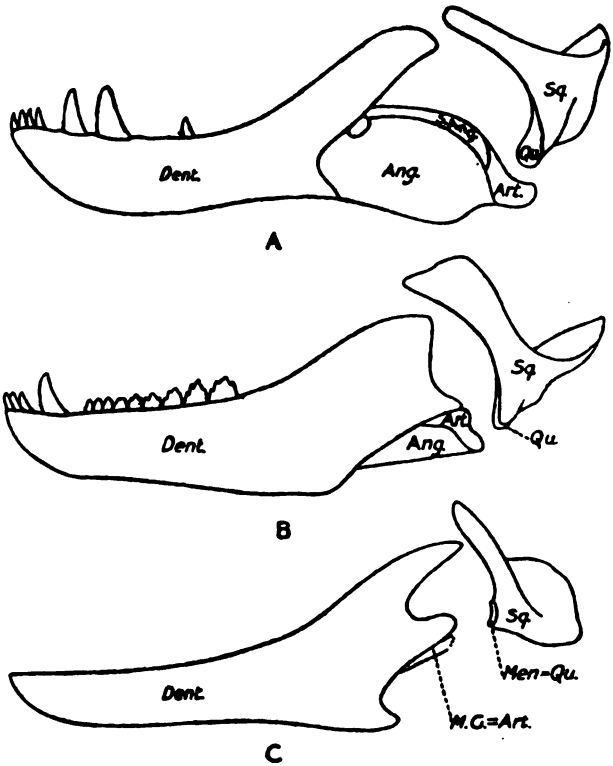
In text-figure 100, A, p. 496, we have a representation of the jaw of a Therocephalian, with the quadrate and squamosal. The large size of the angular is well shown and also the well-developed quadrate. The mouth is supposed to be open.

Text-figure 100, B, p. 496, is a view of the jaw of a Theriodont with the squamosal and quadrate. In this figure also the mouth is open to show the whole of the dentary. The small relative sizes of the articular and angular are manifest, but the most striking feature is the great development of the dentary. It will be seen that though the dentary does not form part of the articulation, very little modification would be required to convert the jaw into one in which the dentary formed the articulation. When the articular surface was transferred to the dentary, the articular element and with it the angular would rapidly degenerate.

Let us now examine the condition of the jaw in a young mammal. Meckel's cartilage is continuous with the malleus, but as the malleus is a hyomandibular element it may be removed, and we have then, as in text-figure 100, C, in addition to the dentary, the posterior portion of Meckel's cartilage. It will be observed that this portion of the cartilage is in close relationship with the condyle. Gadow figures Meckel's cartilage as if it entered the jaw near the angle, but in all the mammalian embryos that I have examined the cartilage lies by the side of the condyle, and where

the angle is well-developed as in Marsupials, the cartilage is always much in front and above it. Whether the splint bone that forms round the under side of the back part of Meckel's cartilage and the processus gracilis is to be regarded as the remains of the

Text-fig. 100.



A.—Mandible of Therocephalian (*Lycosuchus vanderrieti*).

B.—Mandible of Theriodont (*Cynognathus platyceps*).

C.—Mandible of young Mammal.

Ang., Angular; *Art.*, Articular; *Dent.*, Dentary; *M.C.*, Meckel's Cartilage (omitting Malleus, which is Hyomandibular); *Men.*, Meniscus or Interarticular Cartilage; *Qu.*, Quadrate; *Sq.*, Squamosal; *S.Ang.*, Surangular.

angulare, or whether a tiny little additional splint seen in the fœtus of *Ornithorhynchus* is to be so regarded, is at present doubtful. But there is pretty good reason for regarding the posterior part of

Meckel's cartilage as the degenerate remains of the articular. When the quadrate became rudimentary and the dentary took up the articulation, Meckel's cartilage would be brought into line with the malleus, and the two elements, though morphologically quite distinct, ever afterwards would develop as one continuous structure. In the development of *Trichosurus* we find an analogous case of two distinct structures developing as one. Here the coracoids and sternum develop as a single cartilage, though the sternum is a costal structure and not part of the shoulder-girdle.

There remains to be considered the question of the fate of the quadrate. In the Theriodont it is a small bone fixed to the front and lower end of the descending process of the squamosal. When we look in this region in the mammal, we find either the mandible directly articulating with the squamosal, or indirectly owing to the intervention of a thin plate of cartilage. In the large majority of mammals this small cartilage—the interarticular cartilage or meniscus—is present: in only one or two—the Monotremes, *Dasyurus*, *Dasypus*—is it absent as a cartilage: occasionally it is ossified, as in *Pedetes*. Some years ago, I suggested the possibility of this cartilage being the quadrate (9), and all the palæontological evidence which has since been discovered seems but the more strongly to confirm the view. It has been said that if this were so we should expect the cartilage to be most strongly developed in the Monotremes—just where it seems to be entirely absent. It must be remembered, however, that the Monotremes are extremely specialised and in some respects very degenerate. The vertebræ other than the axis are much less like those of the Theriodonts than are those of the Eutheria: in the carpus the os centrale is absent, though still retained in many higher forms; and the mandible in both Monotremes extremely degenerate and very unlike that of the Theriodont, while in the Eutherians the lower jaw resembles the Theriodont jaw very considerably. It does not seem therefore so very strange that the quadrate by taking on a special function in the mandibular joint should be retained in the higher forms though lost in the lower. On the other hand, it is quite possible that the quadrate is entirely absent in all mammals; yet the presence of a cartilaginous structure in a situation exactly corresponding to that of the quadrate in Theriodonts seems strongly to favour the view that in the meniscus we have the modified equivalent of the reptilian quadrate.

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EXPLANATION OF PLATE XXXV.

Fig. 1. Articular region and posterior part of base of skull of *Cynognathus platyceps*. Nat. size.

Figs. 2 & 3. Articular region of *Gomphognathus kannemeyeri*—from the front. Nat. size.

Fig. 4. Articulation of mandible of *Cynognathus* sp.—from below. Nat. size.

Figs. 5 & 6. Articulation of mandible of *Cynognathus* sp.—from the outer side and in section. Nat. size.

7 & 8. Sections of mandible of *Trirachodon kannemeyeri*. Nat. size.

9 & 10. Sections of mandible of *Cynognathus* sp. About ⅔ nat. size.

Fig. 11. Tangential section of articulation of mandible of *Trirachodon kannemeyeri*. Nat. size.

Ang., Angular; *Art.*, Articular; *B.o.*, Basi-occipital; *Dent.*, Dentary; *E.o.*, Ex-occipital; *F.M.*, Foramen magnum; *Ju.*, Jugal; *Pt.*, Pterygoid; *Qu.*, Quadrate; *Sq.*, Squamosal; *Surang.*, Surangular; *Ty.*, Tympanic.

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PRINTED BY TAYLOR AND FRANCIS,

RED LION COURT, FLEET STREET.

No. 1.

ABSTRACT OF THE PROCEEDINGS

OF THE

ZOOLOGICAL SOCIETY OF LONDON.*

January 19th, 1904.

G. A. BOULENGER, Esq., F.R.S., Vice-President, in the Chair.

The SECRETARY read a report on the additions that had been made to the Society's Menagerie during November and December 1903, and called special attention to a fine young male Orang Outang (*Simia satyrus*) obtained by purchase on November 27th.

The SECRETARY exhibited two skins of the Transvaal Bustard (*Trachelotis barrovii*) sent to him by Capt. R. Crawshay, F.Z.S., who had shot the birds at Piet Retief, in the Transvaal. From examination of the contents of the stomachs sent home by Capt. Crawshay, he was able to state that these Bustards devoured ants in large numbers. He also made remarks on the specific differences between *T. barrovii* and *T. senegalensis*.

Mr. R. I. POCOCK, the Superintendent of the Gardens, exhibited two photographs, taken by Mr. J. ffolliott Darling, F.Z.S., of a young hybrid Waterbuck, about three months old, between *Kobus defassa unctuosus* ♂ and *K. ellipsiprymnus* ♀, bred in the Society's Gardens. In general colour it favoured the dam rather than the sire, being decidedly less rufous in tint than the latter, although not so grizzly black as the former. There was, however, practically no trace of the white elliptical rump-mark so characteristic of *K. ellipsiprymnus*, which indicated reversion to the ancestral type of colour.

Mr. OLDFIELD THOMAS, F.R.S., exhibited a Gazelle obtained by Mr. A. E. Butter in N.E. Africa, which he considered to form a new subspecies of *Gazella soemmerringii*. It was defined as follows:—

GAZELLA S. BUTTERI, subsp. n.

General characters of *G. soemmerringii* and *berberana*, but

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* This Abstract is published by the Society at 3 Hanover Square, London, W., on the Tuesday following the date of Meeting to which it refers. It will be issued, free of extra charge, to all Fellows who subscribe to the Publications, along with the 'Proceedings'; but it may be obtained on the day of publication at the price of *Sixpence*, or, if desired, sent post-free for the sum of *Six Shillings* per annum, payable in advance.

markedly smaller than either, and with a distinct pygal band. Skull of an adult male only 198 mm. in basal length.

Hab. S. of Daua River, Boran Country.

Type. B.M. No. 4.1.20.1. Presented to the British Museum by A. E. Butter, Esq.

Mr. Macleod Yearsley, F.R.C.S., exhibited an aneurysm of the abdominal aorta from a Jaguar and photographs of one in a Turtle. Both specimens were in the College of Surgeons' Museum, the latter being Hunterian. The aorta in the case of the Jaguar was extensively atheromatous.

A communication from Mr. Guy A. K. Marshall, F.Z.S., entitled "A Monograph of the Coleoptera of the Genus *Hipporhinus* Schh.," was read. It contained an enumeration of the 138 known species of the genus, of which 50 were described as new.

A paper on "Proposed Additions to the accepted Systematic Characters of certain Mammals" was read by Dr. Walter Kidd, F.Z.S., in which two groups of phenomena were considered. First, the arrangement of hair on the naso-frontal region was dealt with and two leading types described; second, the distribution of whorls in certain forms was held to be of sufficient importance to be included in the description of the species and genera. In both divisions of the subject the results were shown to agree with accepted classification.

Dr. W. G. Ridewood, F.Z.S., read a short paper on "Some Observations on the Skull of the Giraffe," based upon the examination of a series of sections taken at right angles to the median plane of the head, and more or less transverse to the axis of the skull. The investigation was primarily undertaken with the object of arriving at an explanation of the fact that the bases of the paired horns or ossicusps of the adult are much more hollowed out than are those of the young animal; but other features of interest concerning the extent and relations of the cranial sinuses were also dealt with.

Mr. F. E. Beddard, F.R.S., read a note on the brains of the Potto (*Perodicticus potto*) and the Slow Loris (*Nycticebus tardigradus*), and made some observations upon the arteries of the brain in certain Primates that had died in the Society's Menagerie.

Dr. C. W. Andrews, F.Z.S., gave a description of the bones of the pelvis and hind-limb of *Mullerornis betsilei*, one of the small forms of birds of the family Æpyornithidæ. Except for their smaller size and relatively more slender proportions, no important differences from the corresponding bones of such species as *Æpyornis mulleri* or *hildebrandti* were observed, and no light was

thrown by these specimens on the relationships of the Æpyornithidæ as a whole.

A brief account was also given of the distal end of the tibia of a large Ratite bird from the Upper Eocene Beds of the Fayum district of Egypt, its possible affinities were discussed, and the name *Eremopezus eocænus*, gen. et sp. nov., suggested for it.

The chief characters of the bone are: (1) the distal end of the shaft and the articulation are strongly compressed antero-posteriorly; (2) there is no extensor bridge; (3) the intercondylar groove is strongly marked. The specimen indicates a bird rather larger than an Emu.

The next Meeting of the Society for Scientific Business will be held on Tuesday, the 2nd February, 1904, at half-past Eight o'clock P.M., when the following communications will be made:—

1. Mr. R. Lydekker.—On the Subspecies of *Giraffa camelopardalis*.

2. Mr. Oldfield Thomas, F.R.S.—On a Collection of Mammals from Namaqualand.

3. Mr. F. E. Beddard, F.R.S.—On the Arteries of the Base of the Brain in certain Mammals.

The following papers have been received:—

1. Mr. G. A. Boulenger, F.R.S.—Descriptions of Three new Fishes discovered by the late Mr. J. S. Budgett in the Niger.

2. Mr. G. A. Boulenger, F.R.S.—On the Type Specimen of a West-African Fish, *Clarias læviceps* Gill.

3. Mr. Martin Jacoby.—Another Contribution to the Knowledge of African Phytophagous Coleoptera.

4. Mr. Cyril Crossland, F.Z.S.—On the Marine Fauna of Zanzibar and British East Africa.—Polychæta. Part III.

5. Mr. Cyril Crossland, F.Z.S.—The Polychæta of the Maldive Archipelago from the Collections made by Mr. J. Stanley Gardiner in 1899.

6. Mr. J. Lewis Bonhote.—Coloration in Mammals and Birds.

Communications intended for the Scientific Meetings of the Zoological Society of London should be addressed to

P. CHALMERS MITCHELL, *Secretary*.

3 Hanover Square, London, W.
20th January, 1904.

No. 2.

ABSTRACT OF THE PROCEEDINGS

OF THE

ZOOLOGICAL SOCIETY OF LONDON.*

February 2nd, 1904.

H.G. The Duke of Bedford, K.G., President, in the Chair.

Mr. R. Lydekker exhibited and made remarks upon a head of the Alaskan Moose, *Alces machlis gigas*.

Mr. J. E. S. Moore, F.Z.S., exhibited a series of lantern-slides illustrating the Histology of Cancer in Animal tissues.

Mr. R. Lydekker read a paper, illustrated by coloured lantern-slides, on the subspecies of Giraffe (*Giraffa camelopardalis*). The author enumerated ten subspecies and pointed out the distinguishing characters of each.

A paper was read by Messrs. Oldfield Thomas, F.R.S., and Harold Schwann on a collection of mammals from Namaqualaud presented to the British Museum by Mr. C. D. Rudd. It had been obtained by Mr. C. H. B. Grant, and consisted of about 160 specimens referable to 28 species, of which a new Mungoose (*Herpestes ruddi*) had already been described.

The following additional new forms were now named:—

Cynictis penicillata pallidior, subsp. n.

Similar to true *penicillata*, but paler throughout, and with much more white on the end of the tail. Central area of back "buff-yellow" (Ridgway).

Type. Male. No. 399.

Arvicanthis pumilio cinereus, subsp. n.

General colour smoke-grey instead of buffy yellow, the sides especially much clearer grey than in true *pumilio*.

Type. Female. No. 514.

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BATHYERGUS JANETTA, sp. n.

Size much less than in *B. maritimus*. General ground-colour as in that species, but the top of the head and the dorsal area slaty black.

Skull of male 48·5 mm. in basilar length, and of female 40·5; both old.

Type. Female. No. 545.

LEPUS CAPENSIS GRANTI, subsp. n.

Colour above as in true *L. capensis*, below as in *L. c. centralis*; ear-fringes whitish. Nape vinaceous.

Type. Male. No. 561.

A new generic name, *Desmodillus*, was applied to the Gerbille hitherto known as *Gerbillus* or *Pachyuromys auricularis* Smith.

Mr. F. E. BEDDARD, F.R.S., read a paper on the Arteries of the Base of the Brain in certain Mammals, based on observations he had made on individuals that had died in the Society's Menagerie.

Mr. G. A. BOULENGER, F.R.S., gave descriptions of three new species of Fishes discovered by the late Mr. J. S. Budgett in the Niger, during the recent expedition on which he contracted the fatal illness which has terminated a most promising career. Two species belong to the Mormyrs: 1. *Marcusenius budgetti*, allied to *M. petherici* and *psittacus*, with D. circa 32, A. 25, Lat. l. 67, 12 scales round caudal peduncle; 2. *Gnathonemus gilli*, allied to *G. cyprinoides*, with D. 33, A. 31, Lat. l. 85, 14 scales round caudal peduncle, and origin of dorsal fin corresponding to that of anal. The third species is a Silurid of the genus *Synodontis*, named *S. resupinatus*, from the ventral surface being darker than the dorsal, and unique in the character of the maxillary barbel, which combines a broad fringe with short obtuse branches.

In a second paper, Mr. BOULENGER described the type specimen of the Silurid Fish, *Clarias læviceps* Gill, which had been entrusted to him by the Smithsonian Institution. *Clarias kingsleyæ* Gthr. proved to be identical with this species.

The next Meeting of the Society for Scientific Business will be held on Tuesday, the 16th February, 1904, at half-past Eight o'clock P.M., when the following communications will be made:—

1. Mr. CYRIL CROSSLAND, F.Z.S.—On the Marine Fauna of Zanzibar and British East Africa.—Polychæta, Part III.

2. Mr. Cyril Crossland, F.Z.S.—The Polychæta of the Maldive Archipelago from the Collections made by Mr. J. Stanley Gardiner in 1899.

3. Sir Charles Eliot, K.C.M.G.—On some Nudibranchs from Zanzibar and East Africa.—No. IV. Doridida Cryptobranchiatæ.

The following papers have been received :—

1. Mr. Martin Jacoby, F.E.S.—Another Contribution to the Knowledge of African Phytophagous Coleoptera.

2. Mr. Robert T. Leiper.—On *Avagina incola*, gen. et sp. nov., with a Note on the Classification of the Proporidæ.

Communications intended for the Scientific Meetings of the Zoological Society of London should be addressed to

P. CHALMERS MITCHELL, *Secretary.*

3 Hanover Square, London, W.
9th February, 1904.

No. 3.

ABSTRACT OF THE PROCEEDINGS

OF THE

ZOOLOGICAL SOCIETY OF LONDON.*

February 16th, 1904.

HERBERT DRUCE, Esq., F.L.S., Vice-President, in the Chair.

The SECRETARY read a report on the additions that had been made to the Society's Menagerie in January 1904, and called special attention to a Hainan Gibbon (*Hylobates hainanus*) received on deposit on January 25th, and to a Philippine Hornbill (*Penelopides affinis*) presented by Mrs. Johnstone on January 26th.

The SECRETARY read a letter, addressed to Sir Harry Johnston, K.C.M.G., from the late Mr. W. G. Doggett, from Uganda. It contained information, gathered from natives of the Mbogo country, on the Okapi and on a supposed new species of Antelope known to the natives by the name of "Shaw-le."

Prof. E. A. MINCHIN, F.Z.S., exhibited and made remarks upon a specimen of the Spider *Heteropoda regia* (Fabr.) which had been captured at University College, London. This Spider had a very wide distribution, which was probably due to its being carried by the wind during its younger stage and also by ships.

Mr. OLDFIELD THOMAS, F.R.S., read a communication from the Hon. WALTER ROTHSCHILD, M.P., F.Z.S., which contained a description of a new subspecies of *Cephalophus nyasæ*. It was defined as follows:—

CEPHALOPHUS NYASÆ DEFRIESI.

Differs from *C. nyasæ* in the greater extent of red on the flanks and thighs and more intense rufous legs. The belly is much more extensively white; the greyish brown of the upper

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surface is paler and the light streak on the side of the face and over the eye broader and more rufous.

Hab. Northern Rhodesia.

Type, ♂, from Itambe, between Lakes Mweru and Tanganyika; also ♂ and ♀, Kafue River near border of Barotse Land, obtained by Mr. Louis de Fries, after whom it was named.

The SECRETARY gave an account of a paper, contributed by Mr. MARTIN JACOBY, F.E.S., which dealt with the Phytophagous Coleoptera he had lately received in collections from South and West Africa. Seventy-three species—most of them new—were enumerated and described in the paper.

The SECRETARY read a communication from Mr. CYRIL CROSSLAND, F.Z.S., which contained a further account of the collection of Polychæte Worms he had made in Zanzibar and British East Africa in the years 1901 and 1902, and also an account of part of a collection of Polychætes made by Mr. J. Stanley Gardiner in the Maldive Archipelago in 1899. Two new species were described as follows:—

EUNICE TUBIFEX.

Inhabiting, *in adult state*, tubes like those of *E. floridana*, *tibiana*, &c. (Ehlers's 'Blake' Collections.)

Compound setæ with end parts knife-like anteriorly, hooked posteriorly. The gills commence far back and extend to near anus. Young forms found free-living, or in loose tube, differ in form of jaws and distribution of knife-setæ and gills. The species becomes sexually mature while quite small, as does *E. indica* Kbg. from East Africa, ? Ceylon (*Herdman*), ? Funafuti (*Whitelegge*).

NICIDION GRACILIS.

A small form, near to *Eunice brevis* Ehlers. Differing markedly in proportions of body (as names imply).

A second communication from Mr. CYRIL CROSSLAND contained a continuation of the account of the Polychætes collected in the Maldive Archipelago by Mr. J. Stanley Gardiner. Four new species were described as follows:—

CHÆTOPTERUS LONGIMANUS.

First parapodia longer than the succeeding.

CHÆTOPTERUS LONGIPES.

Parapodia of 1st region as in *C. variopedatus*, but rudiment of 9th neuropodium absent. Notopodia of 3rd region long and clavate.

In both species the cirri of the neuropodia as found in *C. variopedatus* are absent, and there are small differences in the setæ.

PHYLLOCHÆTOPTERUS ACICULIGERUS.

Of large size, with eight strong setæ in 4th notopodium. Gill-region of two segments, as in *P. major* Clap.

PHYLLOCHÆTOPTERUS GARDINERI.

Allied to *P. socialis* Clap., but apparently a solitary form, and much larger.

Mr. F. E. BEDDARD, F.R.S., read a paper which contained a detailed account of the arterial and venous systems of Snakes, deduced from an examination of a number of specimens of different species which had died in the Society's Menagerie.

The next Meeting of the Society for Scientific Business will be held on Tuesday, the 1st March, 1904, at half-past Eight o'clock P.M.

A proposal having been made that the hour of the Scientific Meetings should be changed from 8.30 P.M. to 5 P.M., Council desires the opinion of those who habitually attend these Meetings. To ascertain this, the following motion will be moved after the reading of the Minutes:—

> "That it is desirable to alter the hour of the Meetings for Scientific Business from 8.30 P.M. to 5 P.M."

The following communications will be made:—

1. Sir CHARLES ELIOT, K.C.M.G.—On some Nudibranchs from Zanzibar and East Africa.—No. IV. Doridida Cryptobranchiatæ

2. Mr. ROBERT T. LEIPER.—On *Avagina incola*, gen. et sp. nov. with a Note on the Classification of the Proporidæ.

3. Dr. EINAR LÖNNBERG, C.M.Z.S.—On two Specimens of Hybrid Grouse with known Parentage.

The following paper has been received:—

Mr. PERCY T. LATHY, F.Z.S., F.E.S.—A List of the Rhopalocera of Dominica.

Communications intended for the Scientific Meetings of the ZOOLOGICAL SOCIETY OF LONDON should be addressed to

P. CHALMERS MITCHELL, *Secretary*.

3 HANOVER SQUARE, LONDON, W.
23rd February, 1904.

No. 4.

ABSTRACT OF THE PROCEEDINGS

OF THE

ZOOLOGICAL SOCIETY OF LONDON.*

March 1st, 1904.

Dr. A. GÜNTHER, F.R.S., Vice-President, in the Chair.

The following motion, of which notice was given at the Meeting held on February 16th, was put to the Meeting and declared to be lost by a very large majority :—

> "That it is desirable to alter the hour of the Meetings for Scientific Business from 8.30 P.M. to 5 P.M."

Dr. A. GÜNTHER, F.R.S., exhibited and made remarks upon some specimens of hybrids between Reeves' Pheasant (*Phasianus reevesi*), ♂, and the Silver Pheasant (*Euplocamus nycthemerus*), ♀.

Mr. OLDFIELD THOMAS, F.R.S., exhibited the skull of a Buffalo which had been obtained by Col. Delmé-Radcliffe in Ankole, S.W. Uganda. It was of the *Bubalus caffer* type, but was distinguished by the flatness and breadth of the palms of its horns, as compared to their convexity in *B. caffer*. Mr. Thomas considered it to represent a distinct local race, which he proposed to call *B. caffer radcliffei*.

The typical skull measured 505 mm. in basal length, the outer spread of the horns was 1106 mm., and their palm was 295 mm. in breadth, but only about 115 mm. in thickness.

An old female skull was 455 mm. in basal length, with a greatest horn-spread of 845 mm.

Mr. OLDFIELD THOMAS also exhibited a rare Fruit-Bat of the genus *Scotonycteris*, which had been obtained in Fernando Po by

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* This Abstract is published by the Society at 3 Hanover Square, London, W., on the Tuesday following the date of Meeting to which it refers. It will be issued, free of extra charge, to all Fellows who subscribe to the Publications, along with the 'Proceedings'; but it may be obtained on the day of publication at the price of *Sixpence*, or, if desired, sent post-free for the sum of *Six Shillings* per annum, payable in advance.

Mr. E. Seimund, whose expedition had been assisted financially by the Society's President and by Mrs. Percy Sladen.

The Bat, which was the first of its genus to be received by the National Museum, was considered to be new, and was diagnosed as follows:—

SCOTONYCTERIS BEDFORDI, sp. n.

General characters as in *S. zenkeri*, but the ears very markedly smaller, 11 mm. in length instead of 17. Postocular spots smaller Interfemoral more hairy. Forearm 48 mm.

Hab. Fernando Po.

Type. Female. Original number 31.

Mr. J. G. MILLAIS, F.Z.S., exhibited a series of skins illustrating the life-history of the Grey Seal (*Halichœrus grypus*). Up to date this Seal had been poorly represented in European and American Museums and there was no series nor description of the pelages in existence which embraced a complete account of the various types. The skins exhibited by Mr. Millais included every known variation and had been obtained after much labour and several hunting-expeditions. A short account of the geographical distribution of this Seal was also given by Mr. Millais, which included many new localities hitherto unknown to zoologists.

Mr. J. FFOLLIOTT DARLING, F.Z.S., showed some photographs of a very large male specimen of the Woolly Monkey (*Lagothrix humboldti*) seen by him last year in Southern California. He said this was much the largest specimen of this Monkey ever seen by him, that it weighed about 55 lbs., and stood about 3 ft. high when in an erect position. The partiality it exhibited for standing erect was very marked, as was also the intelligent manner in which it used its tail to assist it. This it sometimes had fixed like a perpendicular scroll-brace as if made of wrought iron, and at others held on by it to an iron bar and so helped to preserve its equilibrium.

Dr. WALTER KIDD, F.Z.S., exhibited a drawing of, and read a note on, the arrangement of hair on the nasal region of the Parti-coloured Bear (*Æluropus melanoleucus*), showing that this was of the Derivative type, in which respect it differed from the Ursidæ and the Procyonidæ, and resembled the Felidæ.

Mr. R. E. HOLDING exhibited and made remarks upon a double head of a Lamb and the skull of a Spanish four-horned Ram fractured in fighting.

On behalf of Sir C. ELIOT, K.C.M.G., a paper entitled "On some Nudibranchs from Zanzibar and East Africa, No. IV.," was read Continuing his account of the fauna of this region the

Author dealt with the genera *Chromodoris*, *Casella*, *Ceratosoma*, *Sphærodoris*, *Miamira*, and *Orodoris*, and gave details with regard to twenty-two species, eight of these being described as new.

The new species were in colour as follows, all belonging to the genus *Chromodoris* :—

CHROMODORIS SYKESII.—Dorsal surface bright orange, passing into light yellow towards the edge of the mantle, round which is a double border of reddish brown internally and bright violet externally, with numerous rings of opaque white on the back.

C. CAVÆ.—Yellowish white with drab blotches. Edges of mantle and foot bordered with light violet. On the back are black spots surrounded by a white line, also orange spots. Foot white, with orange and black spots.

C. ANNULATA.—Upper surface white, studded with yellow spots Round the margin a border of deep purple.

C. SPLENDENS.—Colour varying, being produced by thick collections of purple and white dots, in different proportions in different places. A vivid orange border round the body.

C. VICINA.—Mantle and foot bordered with light violet. Middle of the back drab-brown with violet spots. Edge of mantle and foot spotted with yellow.

C. NIGROSTRIATA.—Violet-blue grey, with blotches of light primrose-yellow. On the back and sides of foot are distinct curved black lines.

C. INCONSPICUA.—White with opaque white spots and a few brown ones in the middle of the back. Akin to *C. albonotata* B.

C. FLAVA.—Bright lemon-yellow, with a blood-red border round he mantle-edge.

A communication from Mr. ROBERT T. LEIPER contained a detailed account of the Turbellarian *Avagina incola*, which had been described as new to science at the Meeting of the British Association at Belfast in 1902. This Turbellarian had been found in the accessory canal of several specimens of the Common Heart-Urchin, *Echinocardium cordatum*, collected from Kames Bay, Cumbrae, N.B., in the summer of that year. As well as forming the type of a new genus and species, it was of interest as being the only recorded example of distinct parasitism among the Acoelous Turbellaria. A note on the classification of the Proporidæ was also included in the communication, in which it was proposed by the Author to divide this family into two subfamilies: (1) the Proporinæ, to include those genera with a common genital atrium, viz. *Proporus*, *Monoporus*, and *Böhmigia*; and (2) the Avagininæ, to comprise those genera with male accessoria only, viz. *Haplodiscus* and *Avagina*.

Dr. EINAR LÖNNBERG, C.M.Z.S., contributed a paper, illustrated by photographs, on two specimens of hybrid Grouse between *Lyrurus tetrix* ♂ and *Lagopus lagopus* ♀. These specimens were of interest in the fact that there was no doubt as to their parentage; they are now mounted and set up in the Gothenburg Museum.

The next Meeting of the Society for Scientific Business will be held on Tuesday, the 15th March, 1904, at half-past Eight o'clock P.M., when the following communications will be made:—

1. Mr. F. E. BEDDARD, F.R.S.—Contributions to the Anatomy of the Lacertilia.—I. On the Venous System in certain Lizards.

2. Mr. R. LYDEKKER, F.Z.S.—Note on the Skull and Markings of the Quagga.

3. Mr. P. I. LATHY, F.Z.S.—On Additions to the List of Rhopalocera of Dominica.

Communications intended for the Scientific Meetings of the ZOOLOGICAL SOCIETY OF LONDON should be addressed to

P. CHALMERS MITCHELL, *Secretary.*

3 HANOVER SQUARE, LONDON, W.
8th March, 1904.

No. 5.

ABSTRACT OF THE PROCEEDINGS

OF THE

ZOOLOGICAL SOCIETY OF LONDON.*

March 15th, 1904.

Dr. HENRY WOODWARD, F.R.S., Vice-President, in the Chair.

The SECRETARY read a report on the additions that had been made to the Society's Menagerie during the month of February 1904, and called special attention to two male Asiatic Wapiti, presented by the President on February 23rd, and to a male Kiang (*Equus hemionus*) obtained by purchase on February 26th.

Mr. FRANK SLADE, F.Z.S., exhibited and made remarks upon a living Bantam hen which had on each of her wings a well-developed thumb and claw.

Dr. C. I. FORSYTH MAJOR, F.Z.S., exhibited a skull of *Hystrix leucura* (presented by Captain Stewart Douglas) showing a supernumerary fifth cheek-tooth in both sides of the upper jaw. The superadded tooth was considered to be the last in the series, and therefore a fourth true molar.

Dr. FORSYTH MAJOR also exhibited, on behalf of Dr. R. Broom, C.M.Z.S., two fœtal Springbok skulls, ♂ and ♀, which had calcified upper deciduous canines.

A third exhibition by Dr. FORSYTH MAJOR consisted of an additional minute lower cheek-tooth occurring in a Middle Miocene Shrew (*Sorex pusillus*); this Shrew was intermediate in time as well as in the number of its lower teeth between the Oligocene *Protosorex* and the recent species of *Sorex*.

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Mr. G. A. Boulenger, F.R.S., exhibited a remarkable anterior paddle of an Ichthyosaur from the Lias (?) of Somersetshire, for which he proposed the name *Ichthyosaurus extremus*. This paddle represented an exaggeration of the Latipinnate type, with the intermedium articulating with the humerus, and with radial and ulnar sesamoid bones.

Mr. A. E. Pratt exhibited a series of skins of Paradise-birds which he had recently collected in the Owen Stanley range, British New Guinea; also a series of photographs taken by his son during a two years' residence amongst the natives near the frontier of German New Guinea.

Mr. R. Lydekker read a paper in which he drew attention to the occurrence of vestiges of the pit for the face-gland of the Hipparion in three modern species of *Equus*, namely, *E. caballus*, *E. quagga*, and *E. asinus*, Dr. Forsyth Major having been the first to record this in the case of the two last.

Mr. Lydekker then used this character, together with certain details in the markings, to differentiate *E. burchelli* from *E. quagga*. Finally, the author expressed his belief that certain alleged differences in the colour and markings of various specimens of the Quagga were due to fading, or to the manner in which such markings come out in photographs.

Mr. Lydekker also read a paper on the Wild Ass of Mongolia, of which an example was in possession of the President at Woburn Abbey, and expressed his opinion that it was the true *Equus hemionus* of Pallas, and distinct from the Ass of Tibet and Ladak. The latter he proposed should bear the name *Equus hemionus kiang*.

Mr. R. I. Pocock, the Superintendent of the Gardens, gave a description of a new species of Monkey of the genus *Cercopithecus*, from Benin, naming it *C. sclateri*, after Dr. P. L. Sclater, who monographed the genus in 1893. *C. sclateri* is closely allied to *C. erythrotis*, but differs in having the nose-spot and ear-fringe white, the tail only partially red in its proximal half on the underside, and a black occipital crown as in *C. petaurista*.

Mr. F. E. Beddard, F.R.S., read the first of a series of papers entitled "Contributions to the Anatomy of the Lacertilia." It dealt with the venous system of *Iguana tuberculata*, *Tiliqua scincoides*, and *Varanus griseus*.

Mr. Percy I. Lathy, F.Z.S., contributed a paper which dealt with a collection of Butterflies from Dominica, West Indies, of which three were described as new and thirteen had hitherto not been recorded from the island. The three new species were:—

1. LIBYTHEA FULVESCENS.

Distinguished from *L. carinenta* Cram. and *L. motya* Boisd. by the absence of any white markings above, and from *L. terena* Godt. by the greater extent of black above and the unicolorous character of the fulvous markings.

Type. ♂ in Coll. H. J. Adams. Expanse of wings 50 mm.

2. THECLA SUBOBSCURA.

Allied to *T. vibidia* Hew., but distinguishable by the much darker ground-colour of underside and the larger red patch.

Type. ♀ in Coll. H. J. Adams. Expanse of wings 32 mm.

3. THECLA DOMINICANA.

Allied to *T. angelia* Hew. from Cuba, but the smaller amount of copper-colour above and the dark line of hind wings below being partially edged with red at once serve to distinguish it from that species.

Types. 15 ♂ in Coll. H. J. Adams. Expanse of wings 24–30 mm.

The next Meeting of the Society for Scientific Business will be held on Tuesday, the 19th April, 1904, at half-past Eight o'clock P.M., when the following communications will be made:—

1. Messrs. OLDFIELD THOMAS, F.R.S., and HAROLD SCHWANN, F.Z.S.—On Mammals collected during the Uganda Boundary Commission by Mr. W. G. Doggett.

2. Mr. F. E. BEDDARD, F.R.S.—Contributions to the Anatomy of the Lacertilia.—II. On some Points in the Structure of *Tupinambis*.

3. Dr. P. CHALMERS MITCHELL.—On the Disposition and Morphology of the Intestinal Coils in Mammals.

4. Mr. G. A. BOULENGER, F.R.S.—On the Characters and Affinities of the Triassic Reptile, *Telerpeton elginense*.

5. Mr. HERBERT DRUCE, V.P.Z.S.—Descriptions of some new Species of Butterflies belonging to the Family *Erycinidæ* from Tropical South America.

The following Papers have been received:—

1. Sir CHARLES ELIOT, K.C.M.G.—On some Nudibranchs from East Africa and Zanzibar.—Part V.

2. Mr. F. E. Beddard, F.R.S.—Contributions to the Anatomy of the Lacertilia.—III. On some Points in the Vascular System of *Chamæleon* and other Lizards.

Communications intended for the Scientific Meetings of the Zoological Society of London should be addressed to

P. CHALMERS MITCHELL, *Secretary*.

3 Hanover Square, London, W.
22*nd March*, 1904.

No. 6.

ABSTRACT OF THE PROCEEDINGS

OF THE

ZOOLOGICAL SOCIETY OF LONDON.*

April 19th, 1904.

Dr. HENRY WOODWARD, F.R.S., Vice-President, in the Chair.

The SECRETARY read a report on the additions that had been made to the Society's Menagerie during the month of March 1904, and called special attention to a young female Snow-Leopard (*Felis uncia*), from the Pamirs, presented by Capt. Mackintosh; to two young female Cheetahs (*Cynælurus jubatus*), from Somaliland, presented by Capt. Barnard; to adult male and female examples of the Nisnas Monkey (*Cercopithecus pyrrhonotus*), from Uganda, presented by Mr. C. R. Hall; and to a Potto (*Perodicticus potto*) and two North-African Crowned Cranes (*Balearica pavonina*), from Lagos, presented by Dr. Macfarlane.

Mr. OLDFIELD THOMAS, F.R.S., exhibited some skulls of a small North Australian Rock-Wallaby (*Peradorcas concinna* Gould), illustrating the recently discovered fact that this animal, in common with the Manatee alone of all Mammalia, had a continuously renewed molar series, fresh teeth growing up and pushing forwards from behind *pari passu* with the fall of worn-out teeth in front. No evidence was available as to the number of successive teeth produced in the course of the animal's life, but a minimum of seven molars (that is, three more than the normal) was certain.

Mr. OLDFIELD THOMAS also exhibited the skin and skull of a Hartebeest shot by Mr. F. J. Jackson in Uganda, which he considered to represent a new subspecies, and described it as follows:—

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* This Abstract is published by the Society at 3 Hanover Square, London, W., on the Tuesday following the date of Meeting to which it refers. It will be issued, free of extra charge, to all Fellows who subscribe to the Publications, along with the 'Proceedings'; but it may be obtained on the day of publication at the price of *Sixpence*, or, if desired, sent post-free for the sum of *Six Shillings* per annum, payable in advance.

BUBALIS JACKSONI INSIGNIS, subsp. n.

Allied in essential characters to *B. jacksoni*, but distinguished by having a sharply-defined narrow black line running down the centre of the back, and by the front of all four limbs being blackened, as in *B. lichtensteini*.

Hab. Maanja River, Uganda.

Type. B.M. No. 4.4.19.1. Presented by F. J. Jackson, Esq.

Dr. C. I. FORSYTH MAJOR, F.Z.S., exhibited some remains of *Anthracotherium* obtained by Mr. Oldfield Thomas, F.R.S., from a lignite deposit in Majorca. These remains consisted of two second upper molars and a beautifully preserved penultimate right upper premolar, agreeing with *Anthracotherium magnum* Cuv., the predominant mammalian species in the lignite of Cadibona (Liguria). The age of the Tertiary lacustrine formation of Majorca was thus established to be Middle Oligocene, whereas it had generally been assigned to the Lower Eocene, although Jules Haime had, in 1855, rightly guessed the true age.

Mr. F. E. BEDDARD, F.R.S., exhibited and made remarks upon a series of Avain brains of which the arterial system had been injected.

A paper was read by Messrs. OLDFIELD THOMAS, F.R.S., and HAROLD SCHWANN, F.Z.S., giving an account of the Mammals obtained by the late Mr. W. G. Doggett on the Anglo-German Boundary Commission, and presented to the National Museum by the Commissioner, Col. C. Delmé Radcliffe.

Twenty-one species were referred to, and the following described as new :—

PŒCILOGALE DOGGETTI, sp. n.

Allied to and coloured like *P. albinucha*, but considerably larger.

Dimensions of the type (male):—Head and body 356 mm.; tail 242; hind foot 46; ear 25. Greatest length of skull 60·5 mm.

Hab. Burumba, Ankole, S.W. Uganda.

Type. Male. B.M. No. 4.2.6.7.

TATERA FALLAX, sp. n.

Size large. Coloration as in *Gerbilliscus böhmi*, the tail being similarly white-tipped. Upper incisors each with a single very shallow groove. Bullæ larger than usual.

Dimensions of the type :—Head and body 160 mm.; tail 219; hind foot 43; ear 24. Greatest length of skull 45 mm.

Hab. Burumba, Ankole.

Type. Female. B.M. No. 4.2.6.13.

PROCAVIA BETTONI, sp. n.

Allied to *P. stuhlmanni* Matsch., but darker coloured, the general colour above drab-brown, washed with a warmer tone along the back. Skull markedly smaller than in *P. stuhlmanni*.

Dimensions of the typical skull, in Stage V.:—Greatest length 81 mm.; basal length 75·5; combined lengths of four premolars and two anterior molars 26·7.

Hab. Rogoro, Kikuyu.

Type. Male. B.M. No. 0.1.3.5.

Mr. F. E. BEDDARD, F.R.S., read a second of a series of papers entitled "Contributions to the Anatomy of the Lacertilia," based on observations he had made in the Society's Prosectorium. The present part dealt with some points in the structure of the Teguexin (*Tupinambis*).

Mr. G. A. BOULENGER, F.R.S., gave an account of the Triassic Reptile *Telerpeton elginense*, based on new material recently procured at Loosiemouth by Mr. William Taylor. A study of the new specimens, and a re-examination of those previously described, showed *Telerpeton* to be related to *Procolophon* and *Diadectes*, and therefore to be referable to the Order Cotylosauria of Cope, which the author proposed to keep distinct from the Pariosauria and Anomodontia. Remarks were added on the classification of the Reptilia in two diphyletic series—Theromora and Herpetomorpha; the former including the Pariosauria, Cotylosauria, and Anomodontia, the latter all other orders.

A communication from Mr. HERBERT DRUCE, V.P.Z.S., contained descriptions of twenty-three new species of Butterflies, belonging to the family *Erycinidæ*, from Tropical South America.

Dr. A. SMITH WOODWARD, F.R.S., communicated a paper by Dr. ROBERT BROOM, C.M.Z.S., on the Theriodont mandible and its mode of articulation with the skull. It contained an account of the structure of the mandible in *Cynognathus*, *Gomphognathus*, and *Trirachodon*, and the author showed that the jaw was formed mainly by the dentary bone, while the articulation was formed entirely by the articular. A distinct splenial, angular, and surangular were recognised. The quadrate was a flat bone lying in front of the lower part of the squamosal and also covering its lower edge. Lying directly inwards from the quadrate was a bone which was believed to be the tympanic.

Dr. Broom believed that the mammalian jaw was derived from that of the Theriodont by the dentary forming the articulation and the articular becoming degenerate and the small membrane-bones lost. The malleus was believed to be the hyomandibular, and that part of Meckel's cartilage in the neighbourhood of the

condyle to be the degenerate articular. In the mammal the quadrate was believed to be either lost or represented by the inter-articular cartilage.

The next Meeting of the Society for Scientific Business will be held on Tuesday, the 3rd May, 1904, at half-past Eight o'clock P.M., when the following communications will be made :—

1. Mr. OLDFIELD THOMAS, F.R.S.—On the Osteology and Systematic Position of the rare Malagasy Bat *Myzopoda aurita*.

2. Mr. F. E. BEDDARD, F.R.S.—Contributions to the Anatomy of the Lacertilia.—III. On some Points in the Vascular System of *Chamæleon* and other Lizards.

3. Mr. A. D. IMMS, B.Sc. — Notes on the Gill-rakers of *Polyodon*.

The following papers have been received :—

1. Sir CHARLES ELIOT, K.C.M.G.—On some Nudibranchs from East Africa and Zanzibar.—Part V.

2. Dr. P. CHALMERS MITCHELL. — On the Disposition and Morphology of the Intestinal Coils in Mammals.

3. Dr. G. STEWARDSON BRADY, F.R.S., C.M.Z.S.—On Entomostraca collected in Natal by Mr. James Gibson.

4. Lt.-Col. J. MALCOLM FAWCETT.—On some new or little-known Butterflies, mainly from high elevations in the N.E. Himalayas.

Communications intended for the Scientific Meetings of the ZOOLOGICAL SOCIETY OF LONDON should be addressed to

P. CHALMERS MITCHELL, *Secretary*.

3 HANOVER SQUARE, LONDON, W.
26th April, 1904.

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NOTICE.

The 'Proceedings' for the year are issued in *four* parts, forming two volumes, as follows:—

VOL. I.

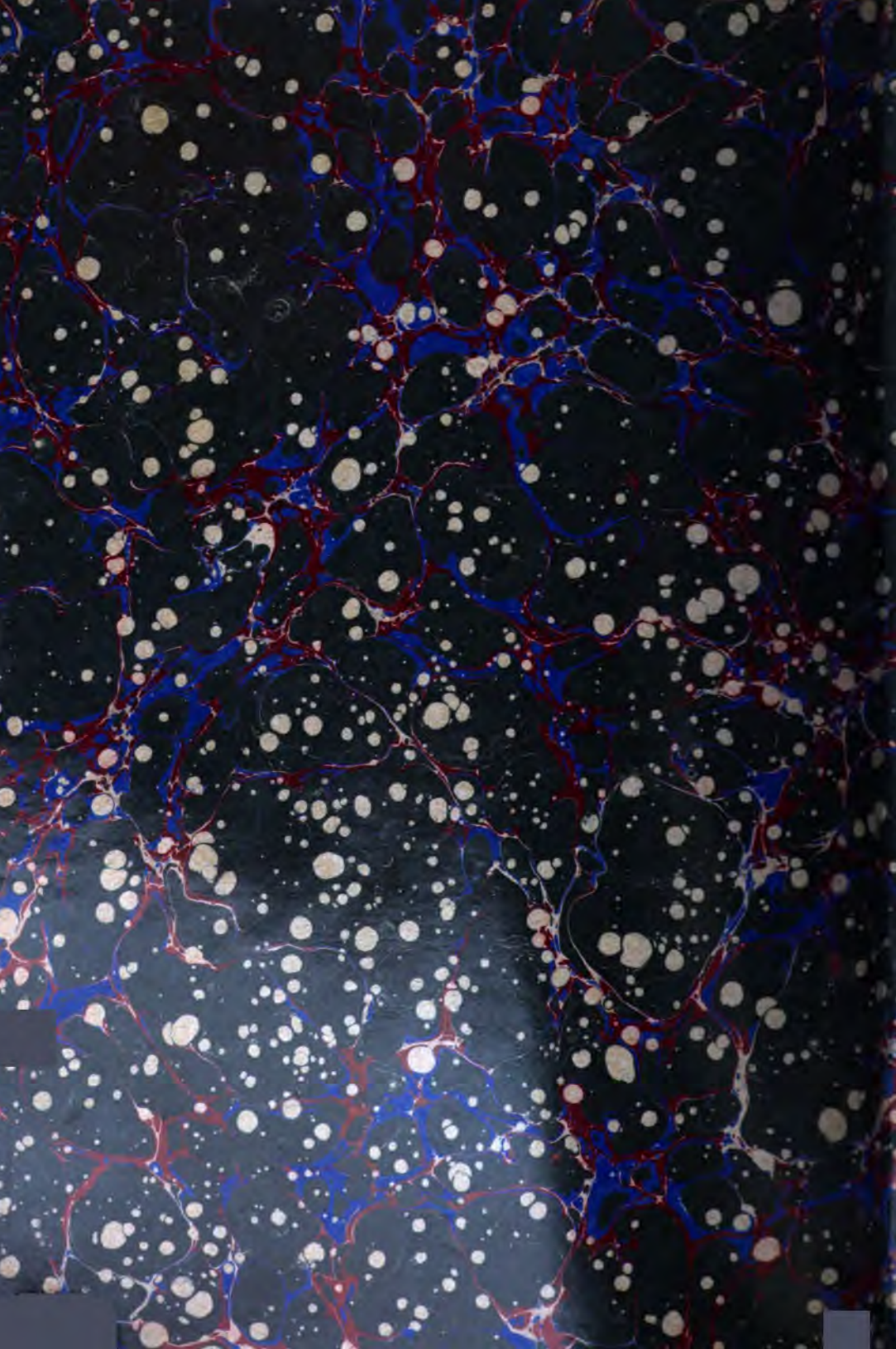
Part I. containing papers read in January and February, in June.
II. „ „ „ March and April, in August.

VOL. II.

Part I. containing papers read in May and June, in October.
II. „ „ „ November and December, in April.

'Proceedings,' 1904, Vol. I. Part I. was published on June 9th, 1904.

The Abstracts of the papers read at the Scientific Meetings in March and April are contained in this Part.



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